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Developing and implementing an Army-specific Information Technology Management Curriculum at the Naval Postgraduate School

Summers, Ann L.

Monterey, California. Naval Postgraduate School

NAVAL POSTGRADUATE SCHOOL
Monterey, California

THESIS

DEVELOPING AND IMPLEMENTING AN ARMY-SPECIFIC INFORMATION TECHNOLOGY MANAGEMENT CURRICULUM AT THE NAVAL POSTGRADUATE SCHOOL

by

Ann L. Summers

September 2001

Thesis Advisor:	Floyd Brock
Second Reader:	Joseph Andrade

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ABSTRACT ***(maximum 200 words)*** As the Department of Defense and the Army move into the 21st Century, the need for quality trained Information Systems Management officers, or Functional Area 53 (FA53) officers, is becoming more and more important to meet the demands of the technologically advanced battlefield. These officers are called upon to manage increasingly complex information systems while maintaining an understanding of the limitations imposed by external factors such as the communications systems on which these information systems reside. To ensure Advanced Civil Schooling (ACS)-educated FA53 officers are receiving an education that enables them to function as a fully qualified FA53 officer, this thesis analyzes a series of related areas. This thesis first addresses the military and civilian ACS institutions from which a FA53 officer may receive an advanced degree in the Information Technology (IT) discipline. This thesis will also address the FA53 task list and directly compare this list with the IT curricula at these institutions. Additionally, this thesis will explore the possible implementation of an Army-specific Information Technology Management curriculum at the Naval Postgraduate School (NPS), the potential increase in Army instructors at the NPS to support such a curriculum, and the necessary procedure for periodic updates to the curriculum.

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DEVELOPING AND IMPLEMENTING AN ARMY-SPECIFIC INFORMATION TECHNOLOGY MANAGEMENT CURRICULUM AT THE NAVAL POSTGRADUATE SCHOOL

Ann L. Summers
Captain, United States Army
B.S., Southwest Missouri State University, 1992

Submitted in partial fulfillment of the
requirements for the degree of

MASTER OF SCIENCE IN INFORMATION TECHNOLOGY MANAGEMENT

from the

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September 2001

Author: _____
Ann L. Summers

Approved by: _____
Floyd Brock, Thesis Advisor

_____
Joseph Andrade, Associate Advisor

_____
Dan Boger, Chairman
Information Systems Academic Group

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ABSTRACT

As the Department of Defense and the Army move into the 21st Century, the need for quality trained Information Systems Management officers, or Functional Area 53 (FA53) officers, is becoming more and more important to meet the demands of the technologically advanced battlefield. These officers are called upon to manage increasingly complex information systems while maintaining an understanding of the limitations imposed by external factors such as the communications systems on which these information systems reside. To ensure Advanced Civil Schooling (ACS)-educated FA53 officers are receiving an education that enables them to function as a fully qualified FA53 officer, this thesis analyzes a series of related areas. This thesis first addresses the military and civilian ACS institutions from which a FA53 officer may receive an advanced degree in the Information Technology (IT) discipline. This thesis will also address the FA53 task list and directly compare this list with the IT curricula at these institutions. Additionally, this thesis will explore the possible implementation of an Army-specific Information Technology Management curriculum at the Naval Postgraduate School (NPS), the potential increase in Army instructors at the NPS to support such a curriculum, and the necessary procedure for periodic updates to the curriculum.

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I. INTRODUCTION

Joint Vision 2020

> The overarching focus of this vision is full spectrum dominance – achieved through the interdependent application of dominant maneuver, precision engagement, focused logistics, and full dimensional protection. Attaining that goal requires the steady infusion of new technology and modernization and replacement of equipment. However, material superiority alone is not sufficient. Of greater importance is the development of doctrine, organizations, training and education, leaders, and people that effectively take advantage of the technology.
>
> The evolution of these elements over the next two decades will be strongly influenced by two factors. First, the continued development and proliferation of information technologies will substantially change the conduct of military operations. These changes in the information environment make information superiority a key enabler of the transformation of the operational capabilities of the joint force and the evolution of joint command and control. Second, the US Armed Forces will continue to rely on a capacity for intellectual and technical innovation. The pace of technological change, especially as it fuels changes in the strategic environment, will place a premium on our ability to foster innovation in our people and organizations across the entire range of joint operations. The overall vision of the capabilities we will require in 2020, as introduced above, rests on our assessment of the strategic context in which our forces will operate.

A. THE PROBLEM DEFINED

1. The Problem

Advanced Civil Schooling-trained Army Functional Area 53 students are not receiving an education that meets Functional Area 53 requirements. The Functional Area system is a product of the Officer Personnel Management System XXI (OPMS XXI) initiative, intended partially to recognize and facilitate the Army's increasing need for specially trained officers in areas other than troop leadership positions. An equivalent civilian position would include jobs such as Chief Information Officer, Information Technology Manager, Network Administrator, Web Developer, Information Technology Consultant, or a combination of these.

The Army looks to the Information Systems Management Officer, or Functional Area 53 (FA53) to keep current on the technology that will one day make the automated battlefield a reality. The FA53 proponent manages the FA53 program and officers, and is located in the Office of the Chief of Signal (OCOS) at the United States Army Signal Center, Fort Gordon, Georgia. The proponent consists of a team of military and civilian personnel led by COL Craig Zimmerman, the Director of the FA53 program, and Mr. Phil Sines, the Chief of the FA53 Officer Division.

While training that focuses on current technology and hands-on applications is good, an education that gives the officer the tools to manage automation assets to their maximum potential and to anticipate future automation resources would provide greater long-term benefit. Approximately 120 students per year are selected for FA53 schooling. Nine of these FA53 officers are sent to Advanced Civil Schooling (ACS) to receive such an education. (PERSCOM, 2001) The remaining students attend the School of Information Technology at Fort Gordon, Georgia. The FA53 proponent manages the curriculum at the School of Information Technology, the primary training facility for FA53 officers. Therefore, the curriculum is regularly updated to meet changing FA53 education requirements. However, while this education focuses heavily on network configuration and management subjects, it devotes almost no time to the broader areas of IT management and utilization.

FA53 officers selected to attend ACS have their choice of nearly 90 colleges and universities from which to choose (Appendix A). Some of these college and universities provide a well-rounded Information Technology education while others do not. Considering the impending importance with which the FA53 officer will be viewed in future Army endeavors, little should be left to chance in their educations. They should be educated at an institution that provides a curriculum that addresses the 61 basic FA53 tasks (Appendix B), as well as allowing for periodic updates to that curriculum as the needs of the Army change.

2. Proposed Solution

The Naval Postgraduate School in Monterey, California is in the unique position to provide this education to the Army FA53 officer. While already providing a well-

rounded and in-depth Master of Science in Information Technology Management program, the Naval Postgraduate School (NPS) has the added benefit of being a like-minded sister service, willing and easily able to support such an education.

3. What May Happen If The Problem Is Not Solved

Information technology (IT) has never been a more important issue. Current Department of Defense publications focusing on future forces indicate IT as a primary strategic asset over the course of the next 20 years. Without a standardized and controllable way of educating ACS FA53 officers, those officers so trained will be at a loss in comparison to their Fort Gordon counterparts. Not having received a comparable education, they will potentially be unable to function as a fully qualified FA53 officer. Their superiors will have certain expectations that will not be met, and the funding that was devoted to their educations will have been wasted. The overall impression of the FA53 program stands to be diminished, with a worst-case scenario including the costly contracting of jobs to civilian organizations that should have been filled by qualified FA53 officers.

B. BACKGROUND

Functional Area 53 is a subset of the Army's Information Operations Career Field (IOCF), which includes the following Functional Areas:

- Functional Area 24 (Telecommunications Systems Engineering)
- Functional Area 30 (Information Operations)
- Functional Area 34 (Strategic Intelligence)
- Functional Area 40 (Space Operations)
- Functional Area 46 (Public Affairs)
- Functional Area 53 (Information Systems Management)
- Functional Area 57 (Simulations Operations) (Draves, 2001).

The IOCF is a direct result of the Officer Personnel Management System XXI (OPMS XXI) initiative, intended partially to recognize and facilitate the Army's

increasing need for specially trained officers in areas other than strictly leadership positions.

> To fulfill the need for war fighters trained with the information related skills necessary to perform in the next century, OPMS XXI created the Information Operations Career Field. Within this Career Field are officers who are information operations specialists capable of integrating and optimizing the Army's relevant information and intelligence, information systems and operations to gain information dominance. (DA PAM 600-3, 1998, section 37)

Typically, a FA53 officer chooses to move from his or her primary branch of service, such as Infantry, Finance, or Signal Corps, to the FA53 program between his or her fifth and sixth year of service (DA PAM 600-3, 1998, section 3). While the officer's previous education is usually considered during the designation of a Functional Area, this is not strictly the case, occasionally resulting in a person designated as a FA53 officer who has little or no information systems experience.

FA53 officers are trained in one of two ways. The majority of FA53 officers are sent to the Fort Gordon School of Information Technology to attend the 10-week Information Systems Operations Leveler (ISOL) Course (Appendix C) back-to-back with the 20-week Information Systems Management (ISM) Course (Appendix D). The remaining FA53 officers are sent to ACS to receive a comparable Master's degree. There are over 90 ACS colleges and universities from which to choose, with degrees ranging in scope and difficulty from a Master of Arts, to a Master of Business Administration, to a Master of Science in Information Technology Management, Management Information Systems, and Computer Information Systems to name a few (Appendix A). While some universities provide an in-depth, wide-ranging view of IT, others focus strictly on one area, such as e-commerce or Chief Information Officer (CIO)-level knowledge.

The FA53 proponent has recently identified a FA53 task list. A task list identifies all the specific skills the FA53 officer must possess in order to function as a fully qualified FA53 officer. This list is of great assistance in further clarifying education requirements for this Functional Area. The Fort Gordon School of Information Technology can easily compare their curriculum to this task list and adjust the curriculum accordingly to meet changing FA53 requirements, particularly as the Functional Area's

purpose in the overall scheme of the Army comes into focus. While a standing list of tasks can benefit the School of Information Technology, it can also be used as a tool to blatantly bring forth the deficiencies inherent in the IT educations received through some ACS institutions.

C. OBJECTIVE AND RESEARCH QUESTIONS

The primary objective of this research is to outline a plan for developing and implementing an Army-specific Information Technology Management curriculum at the Naval Postgraduate School. It is intended to serve as a useful tool to the FA 53 proponent for implementation of this curriculum. The following research questions address this primary objective.

1. **Are the IT educations received at civilian Advanced Civil Schooling institutions meeting the needs of the Functional Area 53?**

Currently, the Army FA53 officer can choose from over 90 colleges and universities from which to receive a degree in IT. While some of these institutions provide a well-rounded education in the numerous facets of IT, others barely touch upon the areas of importance to a FA53 officer, resulting in an expensively and poorly trained FA53 officer. A direct comparison of the curricula provided by these institutions to the standing FA53 task list will give a good idea of how well FA53 education requirements are being met (Appendix E). The colleges and universities selected for this comparison were previously identified by the Army Personnel Command (PERSCOM) Future Readiness and Professional Development department as acceptable ACS institutions (PERSCOM, 2001). In the interest of fairness, the Air Force Institute of Technology (AFIT), the National Defense University (NDU), and the Fort Gordon School of Information Technology will also be considered.

2. **Does the current Information Technology Management (ITM) curriculum at Naval Postgraduate School meet FA53 requirements, and if not, where is the shortfall?**

Through the process identified to answer the first research question, so this question will be partially answered as well. A direct comparison of the NPS ITM curriculum to the FA53 task list will indicate both the current level of FA53 education requirements met as well as identify the shortfall in this curriculum from the perspective

of FA53 education requirements. Remaining unfulfilled tasks point to potential additional Army-specific courses that may need to be added to the curriculum.

3. **Will an Army instructor be needed at Naval Postgraduate School to teach Army-specific courses?**

This is more a financial and political question than a research question, but an issue that needs to be addressed if the overall objective of this thesis is to be met. If there are Army-specific courses that are necessary for the current NPS ITM curriculum to meet FA53 education requirements, it follows that the Army will provide the instructor for these courses. Additionally, this instructor could potentially serve as the liaison officer between the FA53 proponent and the NPS when periodic curriculum updates are conducted.

4. **Is it possible to reduce the Army-specific curriculum schedule to 12 to 18 months and still meet currently identified academic requirements for the degree?**

The majority of IT related Masters degrees earned through civilian ACS institutions take no more than 18 months to complete. In fact, the Army regulation regarding ACS (AR 621-1, Section 2-14) states that the student will be away from his or her primary duty for no more than 18 months, a requirement obviously waived if the student attends NPS. The possibility of reducing the curriculum to 12 to 18 months as opposed to 24 months will be explored, as will the impact of such a reduction on the student's workload and the overall education received.

5. **How should the Army-specific curriculum be updated and when should updates occur?**

To continue to receive maximum benefit from the education received at NPS, the curriculum should be updated regularly to continually respond to the changing needs of the Army FA53 program. Research for this question will include identification of the key personnel involved in the update, a method by which the update could be conducted, and a suitable timeline for updates to the curriculum.

D. METHODOLOGY AND LITERATURE REVIEW

The methodology will be a combination of comparative research, data collection, and interviews to create a working plan for developing and implementing an Army-

specific ITM curriculum at the NPS. The literature review will include research of related Army, Navy, and Department of Defense regulations as well as an in-depth search into specific personnel and financial procedures with potential application to this thesis.

E. EXPECTED BENEFITS OF THIS THESIS

The expected benefits of this thesis are twofold. (1) This thesis will provide a well-documented guideline to the FA53 proponent concerning the development and implementation of an Army-specific ITM curriculum for consideration at the NPS. (2) This thesis considers the NPS's need to receive more sister-service support, and indicates a means for Army compliance.

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II. LITERATURE REVIEW

A. INTRODUCTION

The literature review covers in detail several documents of direct relevance to this thesis, partitioned into five areas.

The first review in Section A covers the Army Training and Doctrine Command's (TRADOC) training development process. It is important to understand this process as it applies to all Army training programs and is relevant to the periodic task list and curriculum updating process. Additionally, the TRADOC training development process was used to develop the model used in the methodology of this thesis.

The second review in Section B focuses on the Information Technology Career Cluster Initiative (ITCCI). Sponsored by the United States Department of Education and the National School to Work Office, the ITCCI is a result of the partnership among the Education Development Center, Inc. (EDC), the Information Technology Association of America (ITAA), and the National Alliance of Business (NAB). The ITCCI creates a national model and career cluster curricular framework for IT careers. Portions of this model were also used to develop the methodology model of this thesis.

The third review in Section C focuses on the current FA53 task list. For ease of comparison, this list is broken down into ten IT subcategories, eight of which are identified by the ITCCI, as opposed to 61 individual FA53 tasks.

The fourth review in Section D is an in-depth look at all colleges and universities from which an Army FA53 officer can receive an IT degree. The aforementioned ten IT subcategories will be applied to these IT curricula to determine a percentage of FA53 education requirements met by each. This information is necessary to determine the worthiness of the educations received at civilian ACS institutions.

The fifth, sixth, and seventh reviews in Sections E, F, and G, respectively are of procedural regulations and policies that directly relate to the development and implementation of an Army-specific ITM curriculum at the NPS. They include Army Regulation (AR) 621-1, *Training of Military Personnel at Civilian Institutions*,

Department of the Army Pamphlet (DA PAM) 600-3, *Commissioned Officer Development and Career Management*, and NPS Academic policy.

The eighth review in Section H is of a related thesis completed in June 2000 by P. Dwight Hunt and Stephen T. Willhelm, two Army students at the NPS. This thesis, entitled "Developing a Core Competency Model for Information Systems Management Officers in the United States Army," provides a fresh look at a potential competency model for FA53 students and also addresses issues such as curriculum content, curriculum updates, and key personnel. The Hunt and Willhelm thesis provided numerous ideas and references that were eventually used in this thesis to illustrate points and strengthen ideas.

B. TRADOC TRAINING AND DEVELOPMENT MODEL

The TRADOC is responsible for training Army soldiers. This task is increasingly important in a peacetime Army, whose mission is to be trained and ready to fight. The mission and vision of TRADOC are shown in Figure 1.

TRADOC Mission
Access the Force
Train the Army for War
Set the Army's Standards and Requirements
Command Assigned Activities and Installations

TRADOC Vision
To prepare the Army for Decisive Victory in the Full Range of Required Joint and Coalition Operations Through:
- Accessing and Training the Army's Soldiers and Leaders and Providing Disciplined Combined Arms Training Environments for Units
- Balanced Development of Concepts, Requirements, and Products in Doctrine, Training, Leadership, Organizations, Material, and Soldiers
- Providing Readiness Infrastructures for Training and Projecting Army Forces
- Building a Command Environment that Promotes Safe, Values-Based, and Disciplined Operations

Figure 1. TRADOC Mission and Vision (After TR 350-70, 1999)

As indicated in their mission statement, TRADOC accesses the force for training shortfalls, as well as sets the Army's training standards and requirements. These two areas of TRADOC's mission will be the focus of this review.

1. TR 350-70 Introduction

The method that TRADOC uses to access the force and determine training standards and requirements is the Systems Approach to Training (SAT), a systematic, spiral approach to making education and training decisions. This approach is described in great detail in TRADOC Regulation (TR) 350-70, but for the purpose of this thesis, an overview will suffice. The SAT is a five-phase process, but these phases do not necessarily have to be followed in a specific order (TR 350-70, 1999). This allows greater flexibility and efficiency to training developers, by enabling them to take advantage of previously designated standards or requirements that do not need to be updated. The SAT process is illustrated in Figure 2.

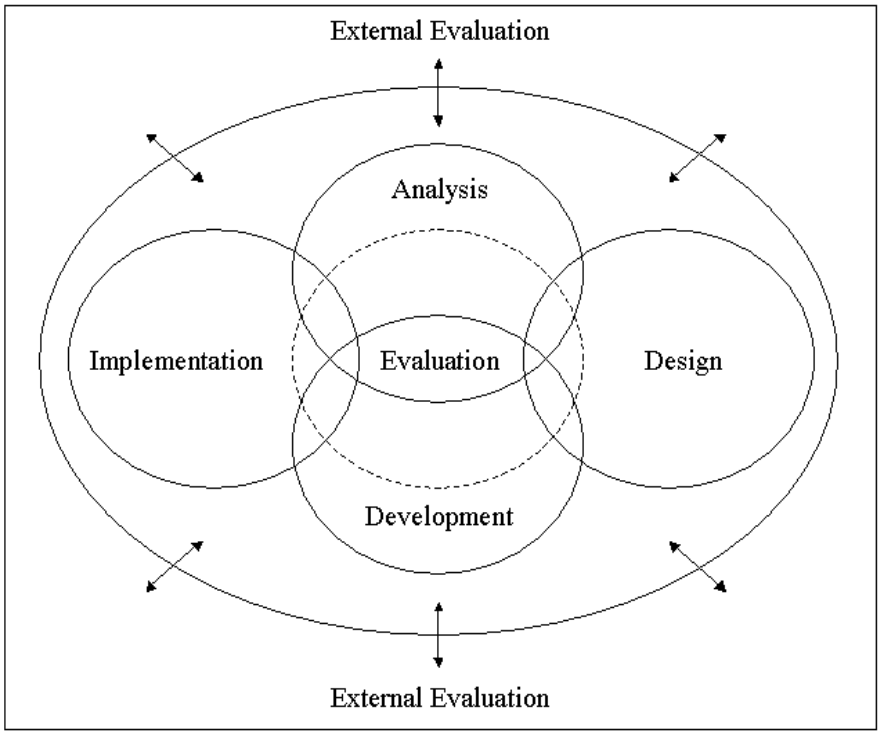

Figure 2. The SAT Process (From TR 350-70, 1999)

The purpose of each phase of the SAT Process is described in Table 1.

Phase	Description
Evaluation	Looks at how the training takes place, determines how army personnel/units perform, and determines need for products to support training.
Analysis	Identifies a need for training, who needs the training, critical tasks, supporting skills, and knowledge requirements for the critical tasks.
Design	Determines where, when, and how the training will take place, as well as training resource requirements (i.e. instructors, equipment, facilities).
Development	Produces validated training and training products.
Implementation	The training/course start date, it executes standardized training at training sites, distribution, and use of training products.

Table 1. SAT Phase Description (After TR 350-70, 1999)

This thesis potentially touches on all five phases of the SAT process but most specifically on development, implementation, and evaluation. With a FA53 task list identified (Analysis) and with training established at both Fort Gordon and various ACS institutions around the country (Design), this thesis will consider the intricacies of Development, Implementation, and Evaluation only.

2. Individual Training Development

Part VI of the Army's XXI Training Development Vision - Individual Training Development (TR 350-70, 1999) prescribes policy and procedures for:

- Identifying critical individual tasks.
- Identifying critical individual task performance specifications, including critical individual task standards.
- Establishing individual training strategies.
- Translating critical tasks and supporting skills and knowledge into learning objectives for training.

- Developing individual training products and material for use in individual training.
- Critical individual tasks are those tasks at which the soldier must be proficient in order to be considered fully qualified in his or her Military Occupational Specialty (MOS).

The FA53 proponent has already developed a task list, so identification of the individual tasks in the scope of this thesis is moot. However, this section on Individual Training Development does give an excellent set of guidelines for critical task list evaluation (Job Analysis Description and Requirements Process) and training evaluation (the Individual Training Evaluation Process). By combining these two sets of guidelines, a comprehensive evaluation tool could be developed that meets the specific needs of FA53 task evaluation and corresponding curriculum evaluation at NPS. This regulation does not, however, give sufficient guidelines for the implementation of such a program at a sister-service institution of higher learning.

a. Job Analysis Description and Requirements Process

> Job Analysis is the process used to identify individual tasks that are critical to job performance that a job incumbent must perform to successfully accomplish his or her mission (TR 350-70).

In a fast moving field such as IT, this process could easily double as a method for updating the task list, and that is the capacity in which it will be used for this thesis. The nine-step Job Analysis process, illustrated in Figure 3, begins with job identification and ends with a critical task list.

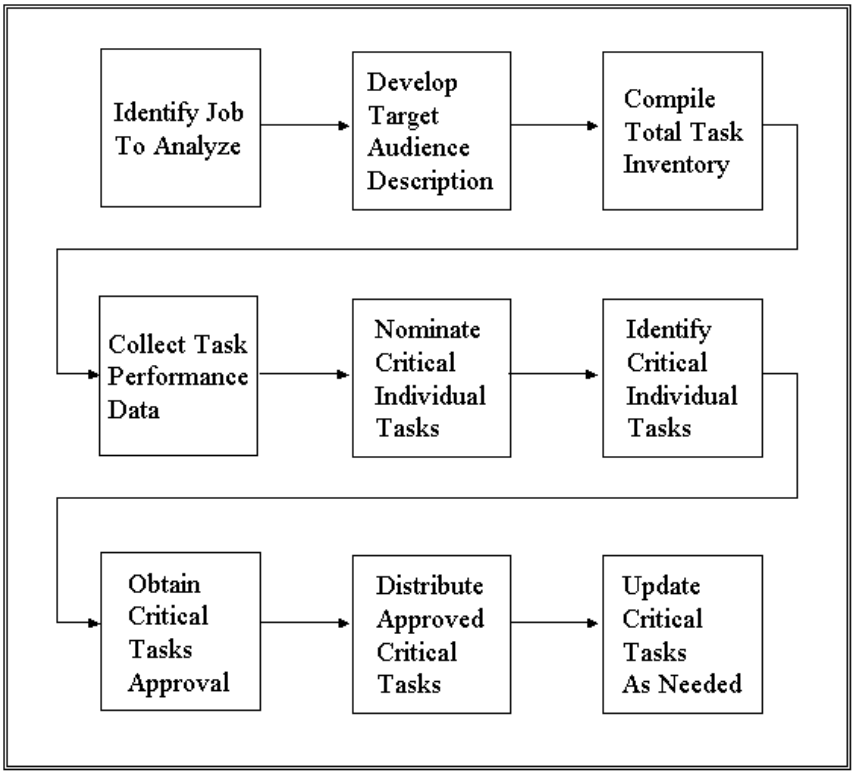

Figure 3. Job Analysis Process (From TR 350-70, 1999)

The Job Analysis process is further described in Table 2.

Steps	Activities
Identify job to analyze	Receive an approved training development (td) requirement for a job analysis
Develop the Target audience description	Determine skill and knowledge level, previous training received, reading grade and math skill level, Armed Service Vocational Aptitude Battery (ASVAB) score required
Compile total Task inventory	Conduct job familiarization, identify tasks from subject matter expert (SME) interviews, extract tasks from references, mission analysis data, collective task analysis data, assign a temporary task number to each task title
Collect task performance data	Establish criteria for critical task selection, select critical task selection model, determine task performance data collection method, construct/coordinate/conduct a survey, compile the task survey data, conduct statistical analysis
Nominate critical individual tasks	Conduct a task selection board, apply selection criteria and critical Task selection model
Identify critical individual shared tasks	Coordinate with task proponent for task analysis data and the Training Support Package (TSP)
Obtain critical individual task List approval	Provide complete recommended task list to the training/TD (task) Proponent commander/commandant for approval
Distribute the approved critical task list	Provide a copy of the approved critical task list to the office(s) that will conduct the individual task analysis
Update task list Based on individual task analysis findings	When the follow-on task analysis determines that (a) a task is really two tasks, (b) the approved critical task is not a task, or (c) a task was omitted, then obtain approval of revised task list from the approving authority and distribute the revision

Table 2. Job Analysis Process Description (After TR 350-70, 1999)

b. Individual Training Evaluation Process

The evaluation process is always a key factor in a training program, but particularly so in a field that changes as often as IT. The FA53 job description and task

list are likely to remain an elusive, moving target for a long time. Remaining satisfied with the job description and task list for too long will only result in the needs of the Army outgrowing and overrunning the Functional Area. The evaluation process must:

- Provide an in-depth inquiry into all phases of a training program and the application of the training development process as a whole.
- Provide empirical evaluation data for making objective judgments related to the need for new or revised training.
- Determine the learning effectiveness of the training program, course, product, or material.
- Determine if soldiers and leaders are technically competent in the performance of individual critical tasks.
- Provide positive feedback concerning effective, efficient training as appropriate.
- Examine each program and product during each state of preparation.
- Ensure training and training programs are accurate, current, relevant, resource efficient, and effective in terms of changing equipment, concepts, and organizations.
- Test the agreement between the training objectives and the real-world job or mission requirements (TR 350-70).

The evaluation procedures identified in TR 350-70 are indicated in Table 3.

(1) Formulate school evaluation policy
(2) Develop evaluation plans
(3) Design and validate evaluation instruments
(4) Conduct internal evaluation (collect data)
(5) Validate training products and materials
(6) Conduct accreditation (collect data)
(7) Analyze data
(8) Identify deficiencies
(9) Report evaluation results
(10) Conduct evaluation follow up

Table 3. Evaluation Procedures (After TR 350-70,1999)

C. INFORMATION TECHNOLOGY CAREER CLUSTER INITIATIVE (ITCCI)

The Information Technology Career Cluster Initiative (ITCCI) is a program sponsored by the United States Department of Education and the National School to Work Office. It is the result of a partnership among the Education Development Center, Inc. (EDC), the Information Technology Association of America (ITAA), and the National Alliance of Business (NAB) intended to "create a national model and career cluster curricular framework for IT careers that involve the design, development, support and management of hardware, software, multimedia and systems integration services (Guilfoy, 2001)." The IT Career Cluster Model, shown in Figure 4, is the framework upon which this initiative bases IT curricula. While the Army is not at this point prepared to provide the officer with lifelong IT training, the point on this figure that is of interest to this research is the identification of eight IT Technical Foundation Standards. With the addition of two standards to accommodate FA53-specific needs, all 61 tasks in the FA53 task list fall under one of these 10 standards, making it a convenient tool for comparing IT curricula. The names of some of these standards have been slightly modified to better represent FA53 areas of interest. Additionally, the scopes of two of

the standards have been broadened in a manner consistent with FA53 training conducted at the Fort Gordon School of Information Technology.

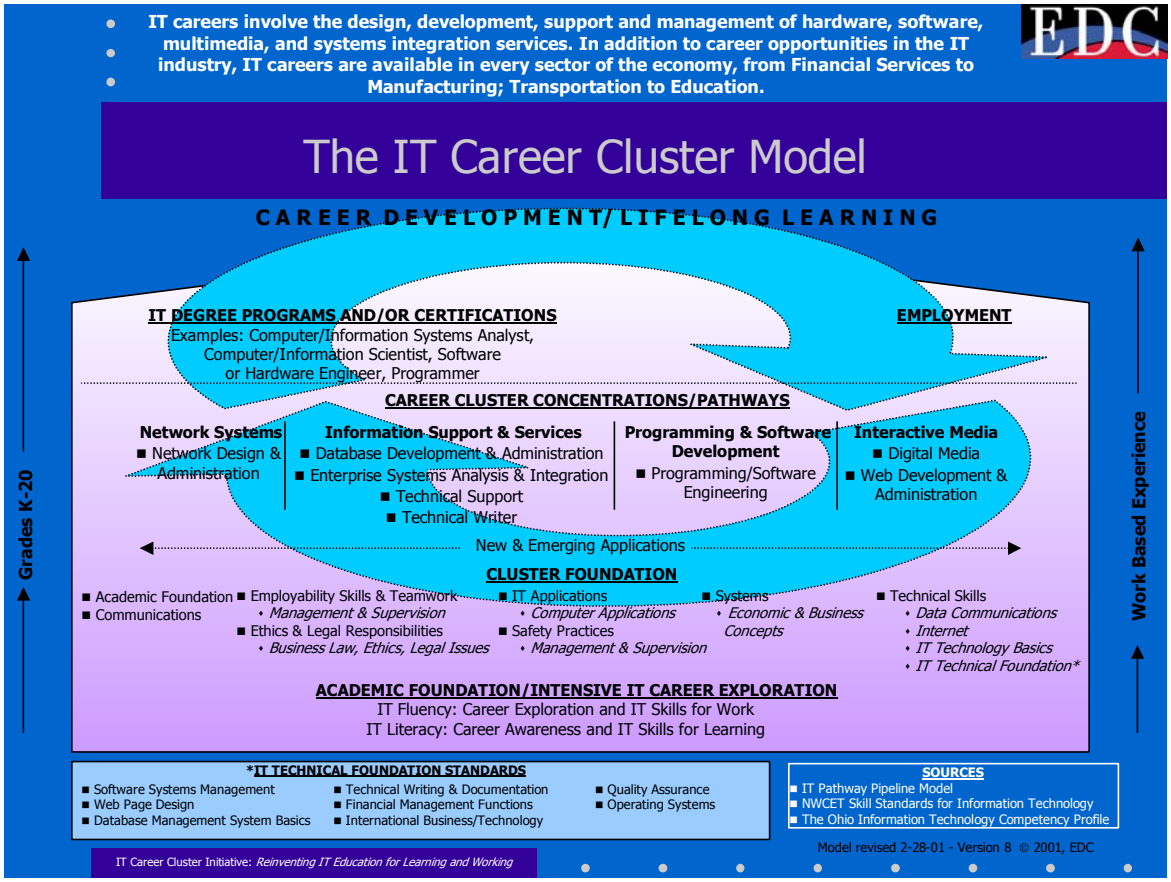

Figure 4. IT Career Cluster Model (From Guilfoy, 2001)

The eight IT Technical Foundation Standards that are indicated by the ITCCI (Guilfoy, 2001), and will be considered in this thesis are:

- Software Systems Management
  Renamed: Programming and Software Systems
- Web Page Design
  Renamed: Internet Application Development
- Database Management System Basics
  Renamed: Database Management Systems
- Technical Writing & Documentation

- Financial Management Functions
- International Business/Technology
  Renamed: Inter-Service and International Capabilities
- Quality Assurance
  Renamed: Information Systems Management
- Operating Systems
  Renamed: Networking Technology, Hardware/Software/Operating Systems

The two additional IT standards necessary to cover the remaining FA53 tasks are:

- Information Security and Assurance
- Tactical Networks and Communications Systems

Henceforth in this thesis, the 10 IT standards will be referred to as IT subcategories.

D. FUNCTIONAL AREA 53 TASK LIST

The Functional Area 53 task list is a compilation of all 61 tasks a fully trained FA53 officer is expected to be able to perform (Appendix B). Some of these tasks overlap, however, creating a certain amount of redundancy in the task list. A more efficient way to view the FA53 task list for the purpose of this thesis is to separate the 61 tasks under their prospective IT subcategories, as explained in the previous section. Clearly a possible outcome of this action is to potentially overlook a specific skill, but to expect that any IT curriculum would be able to meet 100 percent of FA53 education requirements is unrealistic. Even the School of Information Technology at Fort Gordon cannot prepare the officer for every possible contingency. The FA53 education requirements are simply too broad. Furthermore, the likelihood of the officer walking into a brand new, undocumented automation situation is also unrealistic. Most duty positions to which an officer will be assigned will already have established some Standard Operating Procedures (SOPs). This can serve as a starting point for the officer. Additionally, regardless of the training the officer has already received, many duty positions require supplemental training on specific equipment and concepts that will be provided to the officer upon arrival at that duty station. The most important function of the IT curriculum is that it provides the FA53 officer with all the IT tools necessary to be

successful in the work environment. Appendix B gives the detailed breakdown of the 61 FA53 tasks into their 10 prospective IT subcategories.

E. ADVANCED CIVIL SCHOOLING COLLEGE AND UNIVERSITY OPTIONS

Appendix A lists the current ACS colleges and universities available to the FA53 student, as well as the IT related degree offered at each institution. To further determine the potential worthiness of the educations received at these institutions, a consolidated comparison of each institution's IT curricula with the ten IT subcategories can be found in Appendix E. This information was compiled from the Web sites of each college and university, and a determination was made based on the most detailed curricula information obtainable through the Web site.

F. AR 621-1 INTRODUCTION

Army Regulation 621-1, *Training of Military Personnel at Civilian Institutions*, "provides policies for full-time educational programs for Active Duty commissioned and warrant officers in civilian schools, commerce or industry, and service schools that offer accredited degrees (AR 621-1, chapter 1)." This regulation indicates, among other things, that the officer is to "attend school full time, uninterrupted for a maximum of 18 months (AR 621-1, chapter 2)." Exceptions to this policy are found in AR 621-1, chapter 3.

G. DA PAM 600-3 INTRODUCTION

Department of the Army Pamphlet 600-3, *Commissioned Officer Development and Career Management,* is intended

> …first and foremost, as a professional development guide for individual officers. It also serves as a mentoring tool for leaders at all levels and is an important personnel management guide for assignment officers, proponents, and Headquarters, Department of the Army (HQDA) selection board members. This pamphlet focuses on the development and career management of commissioned officers of the United States Army (DA PAM 600-3, chapter 1).

DA PAM 600-3 also serves as a guide to Officer Professional Management System XXI (OPMS XXI), the initiative that brought into being the current Functional Area system.

Chapter 43 of DA PAM 600-3 give a brief outline of the Information Systems Management Functional Area (FA53) as well as officer characteristics required, critical officer development assignments, assignment preferences and precedence, duration of critical officer life cycle assignments, and key officer life cycle initiatives.

H. NAVAL POSTGRADUATE SCHOOL ACADEMIC POLICY

Academic policy at Naval Postgraduate School is of key importance to this thesis, as one of the primary goals is to develop an Army-specific ITM curriculum that meets current NPS academic requirements for the degree.

1. Academic Requirements for a Master of Science in Information Technology Management

Current academic policy indicates that for a student to earn the Master of Science in Information Technology Management from the NPS, he or she must complete the following requirements:

- Completion or validation of core courses in each of the following disciplines:

  Information Systems
  Computer Science
  Electrical and Computer Engineering
  Systems Management

- Completion of a minimum of 52 hours of graduate-level courses, at least 20 of which are at the 4000 level.

- Completion of an acceptable thesis.

- Approval of the candidate's program by the Chair, Information Systems Academic Group (NPS, 2001).

2. Current Army IT Curriculum

There is currently a typical Army curriculum being taught at NPS, as provided by the Information Systems Technology curricular office, but there is no documentation supporting this curriculum as being submitted or developed by the Department of the Army. This curriculum is outlined in Appendix F.

I. RELATED THESIS

The June, 2000 thesis entitled, "Developing a Core Competency Model for Information Systems Management Officers in the United States Army" by P. Dwight

Hunt and Stephen T. Willhelm of the NPS was referenced extensively during research for this thesis, primarily due to its current completion date and direct relevance to this area of study. The Hunt and Willhelm thesis was instrumental in focusing my efforts, since my original thesis idea included research already conducted by Hunt and Willhelm. This enabled me to use their thesis as a springboard, freeing me to focus attention on a different aspect of FA53 development. It is highly recommended that this thesis and the Hunt and Willhelm thesis be considered simultaneously. The IT competency model described by Hunt and Willhelm is ideally suited to be used as the critical number 2 and number 6 steps in the broader Figure-8 Model that I developed (see Chapter III) to illustrate comparison of FA53 competencies to the overall mission.

J. SUMMARY

The literature areas addressed are intended to provide a framework that should prepare the reader for analysis of the data. Knowledge of the Training and Development Model in TR 350-70 helps the reader understand the Army perspective concerning development of a training program. Additionally, the model used in the methodology section of this thesis is a conglomeration of many of the ideas found in the original Training and Development Model, arranged to meet the needs of a technology dependant Functional Area. The Information Technology Career Cluster Initiative review informs the reader where 8 of the 10 IT subcategories originate. The current FA53 task list is a key document, around which the entire Army FA53 IT curriculum at the NPS will be built. The comparison of all ACS colleges and universities to which a FA53 officer may attend is necessary to determine the worth of the educations received. AR 621-1 dictates regulations and guidelines for training Army officers at civilian institutions. DA PAM 600-3 further identifies the FA53 officer and the OPMS XXI initiative that created the Functional Area program. Finally, it is important to understand academic policy at NPS, as these requirements must also be met. The current Army IT curriculum taught at NPS will serve as a basis for the revised curriculum.

III. METHODOLOGY

A. INTRODUCTION TO THE FIGURE-8 MODEL

To better illustrate and validate the findings in this thesis, I have developed a cyclical mission and education update model, appropriately named the Figure-8 Model. This model is based primarily off the TRADOC Training and Development Model and Systems Approach to Training (SAT) outlined in the Literature Review. It is, however, modified to take into consideration the particular needs of a technology dependant functional area, such as incorporating a backdoor approach to mission identification. Additionally, it is intended that this model be utilized on a continuous basis. This model is illustrated in Figure 5.

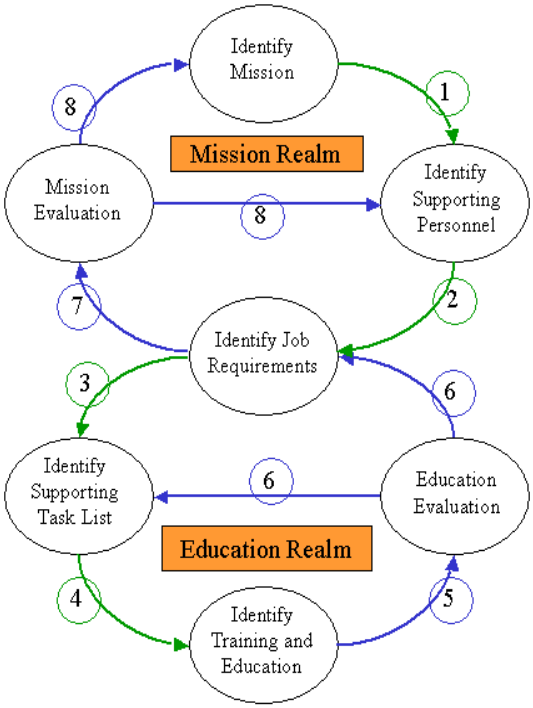

Figure 5. The Figure-8 Model

All research questions to be answered by this thesis will relate directly back to a portion of the Figure-8 model. The model is not intended to provide an in-depth look at all factors and procedures inherent to aligning an education process with mission requirements. It is intended to be a simple depiction of how that process should be

conducted in an arena of constant volatility. This model, although applied to FA53 task identification for the purpose of this thesis, could easily be applied to any functional area that is technology dependant.

The model breaks down into two realms, the Mission Realm and the Education Realm. These two areas mutually depend on each other where a technology-related functional area is concerned. Without a mission planning process that is continually responding to external factors such as shifts in technology or paradigms, the education process will be untimely, producing officers that can respond to yesterday's mission, but not necessarily today's mission. Without an education system that is efficient, flexible, and willing to react to changes in the mission, the mission potentially goes unfulfilled. The hinge point for these two realms is the identification of specific job requirements. This is the one factor that the two realms share in common, and the single most effective point at which to ensure that both realms are correctly aligned.

B. DETAILED EXPLAINATION OF THE FIGURE-8 MODEL

The model explains an eight-step process with the ultimate goal of aligning the education process with mission requirements. These steps are individually described as follows:

1. Identify Supporting Personnel

Once the mission has been initially identified, the next step is to ensure that enough generally trained personnel are present to accomplish that mission. Clarified training is accomplished in a subsequent step. For example, if the mission includes installation of Video Teleconferencing (VTC) equipment from a field location, the necessary officer personnel may be identified as a Signal officer, who could rightfully be held responsible for overseeing the communications network that supports the conference and a FA53 officer who could rightfully be required to understand configuration of VTC equipment. Figure 6 illustrates the first step in this process.

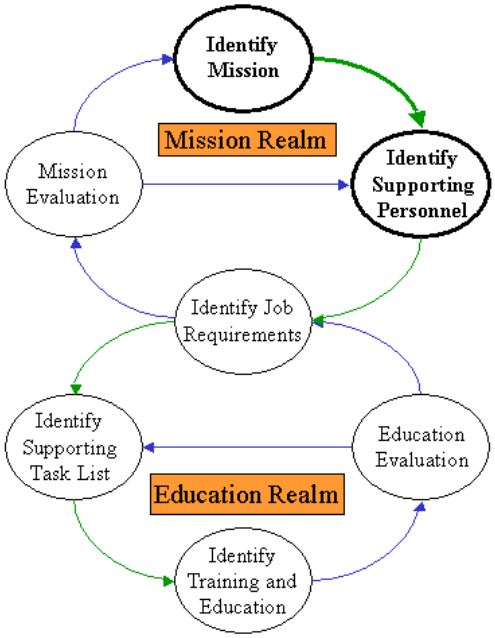

Figure 6. Identify Supporting Personnel

2. Identify Job Requirements

The second step in the Figure-8 model process is to clarify the specific job requirements for the personnel identified as necessary to accomplish the stated mission. For the VTC example, the need for a Signal officer and a FA53 officer has already been established with respect to the mission of supplying VTC to field locations. This capability now translates into a portion of the job description for each of those officers. The Signal officer contributes to this mission by overseeing the communications network across which the VTC signal will pass. The FA53 officer contributes knowledge of the actual equipment and the configuration of this equipment under varying circumstances, usually dictated by the communications network. These contributions now become part of each officer's job requirements. Figure 7 illustrates this step.

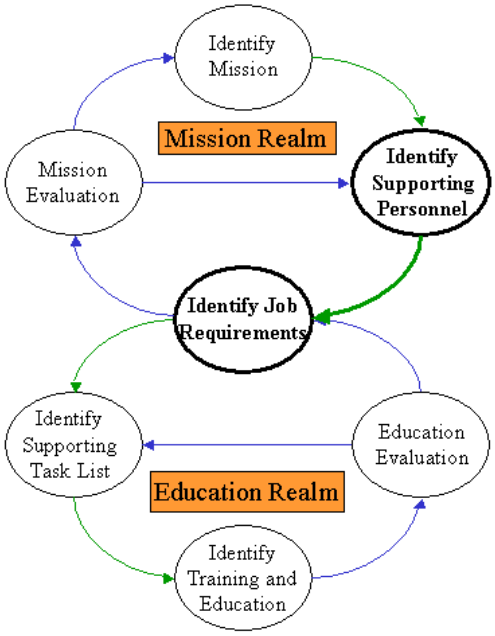

Figure 7. Identify Job Requirements

3. Identify Supporting Task List

Once job requirements have been identified, they should be broken down into detailed tasks that comprise the requirements. In the case of the VTC example, a FA53 officer that can competently fulfill the requirement of providing VTC capabilities from a field location will have a thorough understanding of standard VTC equipment, possible configurations of that equipment, and enough of an understanding of the supporting communications network to determine the correct configuration and what to expect in terms of bandwidth. These pieces of knowledge translate into tasks. Clearly one task can apply laterally across numerous requirements. Conversely, the recent rise in the popularity of the Commercial Off The Shelf (COTS) concept of purchasing hardware and equipment makes fulfillment of some of these tasks challenging, as there is no standard set of VTC equipment inherent across all Army field units. If there was a standard VTC equipment requirement, however, training on that specific set of equipment should be included in the task list. Figure 8 illustrates this step.

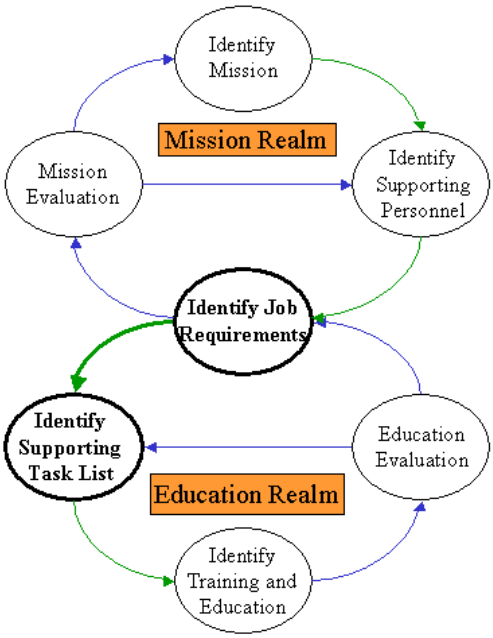

Figure 8. Identify Supporting Task List

4. Identify Training and Education

Upon identification of a detailed supporting task list, a thorough training and education plan may now be developed. While it may seem that producing an education plan to specifically cover all tasks indicated in the task list would require too much time and money, remember that many tasks will laterally overlap different requirements. For example, by teaching the FA53 officer about the underlying communications network that will support the mission of providing VTC from a field location, he or she can also apply this knowledge to all field-based missions that will require an existing communications network, such as tactical local area networks (LANs) and tactical web-based battlefield tracking systems. Both are prevalent areas of interest on the modern battlefield, and both supported by the same communications network. Further, the officer can apply the conceptual knowledge of tactical communications networks to garrison communications networks, which are similar. Therefore, one training session could potentially aid the FA53 officer in a plethora of communication and automation situations. Figure 9 illustrates this step.

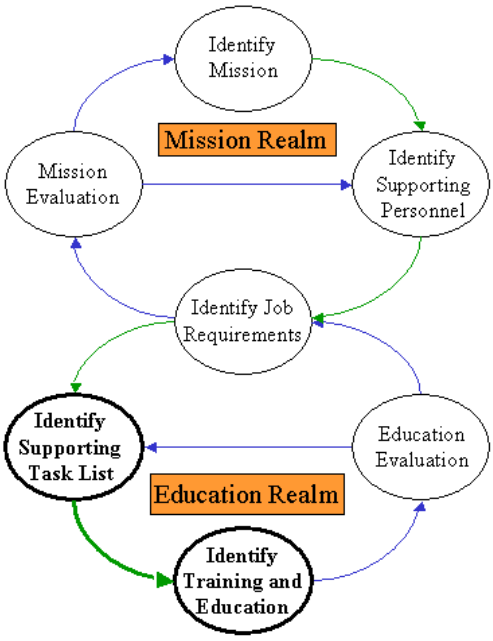

Figure 9. Identify Training and Education

5. Education Evaluation

The Education Evaluation serves a two-fold purpose, to determine completeness of the Supporting Task List, and to provide input for updating the Identify Job Requirements task. This evaluation is concerned only with these two factors. During the course of the evaluation, the fact that a FA53 officer can only accomplish a portion of a requirement may indicate that the task list does not break down the requirement thoroughly enough. The task list can be directly updated, as this change involves the individual tasks, not the job requirement. If, however it is determined that the FA53 officer is entirely lacking in a necessary job skill, this clearly prompts the addition of a job requirement and subsequent development of supporting tasks. Figure 10 illustrates this step.

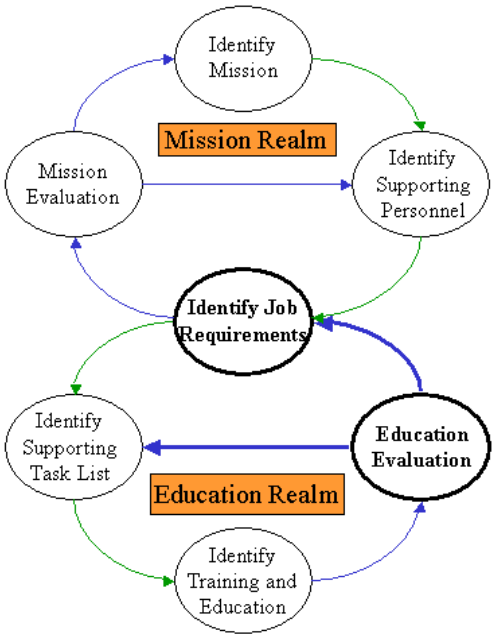

Figure 10. Education Evaluation

6. Identify Job Requirements

The sixth step in this process again indicates the identification of job requirements. This is the point at which all educational issues have been considered, and there is input into the job requirements from an academic standpoint. This input is the result of the Education Evaluation process, a process that takes into account the varying jobs to which a FA53 officer can be assigned and the depth to which each requirement must be learned. If the job requirements remain the same, the model continues to step seven, Mission Evaluation. If there has been a change to the job requirements as a result of the Education Evaluation, the model continues back down to the Education Realm to step three, Identify Supporting Task List. Figure 11 illustrates this step.

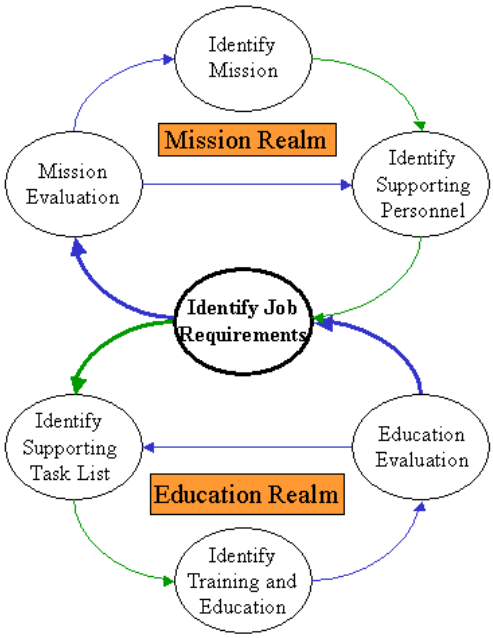

Figure 11. Identify Job Requirements

7. Mission Evaluation

The purpose of the Mission Evaluation is also two-fold. It is concerned with analyzing how well the mission is being met through the currently identified job requirements, as well as determining if there is the right amount and type of officers to accomplish the mission. The Mission Evaluation will first look at shortfalls in mission accomplishment from the perspective of people. If there are not sufficient personnel in place to accomplish the mission, that situation is first corrected in step one, Identify Supporting Personnel, and the model continues sequentially. If a lack of personnel is not the issue, but rather a potential shift in the mission itself, this input is forwarded to step eight, Identify Mission. Figure 12 illustrates this step.

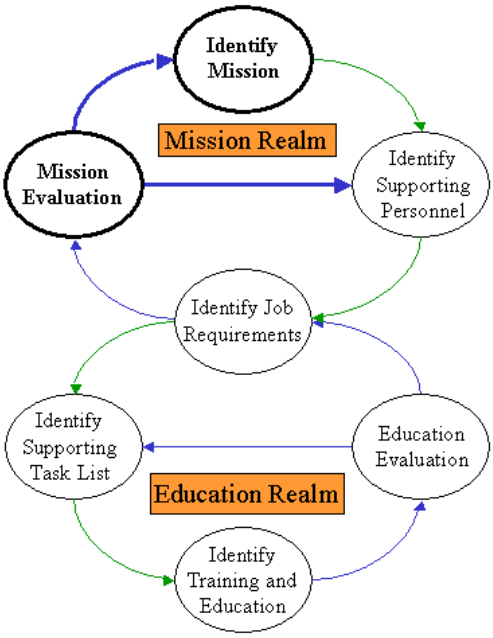

Figure 12. Mission Evaluation

8. Identify Mission

While the success of this backdoor approach to mission identification may seem unlikely, consider the variables inherent in a technology dependant functional area. The officer is faced with a technological environment that renews itself in the short timeframe of 18 to 24 months (Turban, Rainer, and Potter, 2001). As new technology emerges and planners become aware that this technology could be of some use in fulfilling visions such as JV2020, it is conceptually incorporated into strategic level planning. Academic technological resources are often far ahead of those of Army mission planners. It is quite feasible that through an aggressive, continuously updated planning cycle such as the one depicted in the Figure-8 Model, the FA53 officer can potentially be placed in the position to not only anticipate the Army's future IT needs, but already possess the education required to fulfill these needs even before the mission is officially established. This places the FA53 officer, and thus the Army, in the position of controlling, rather than being controlled by, technology. Figure 13 illustrates this step.

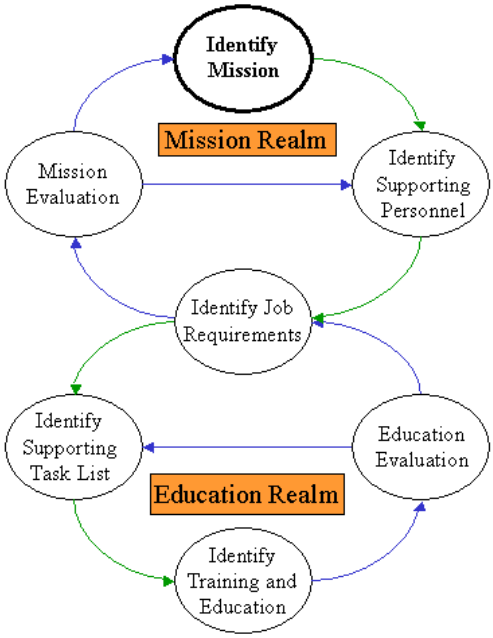

Figure 13. Identify Mission

C. DETAILED ANALYSIS OF RESEARCH QUESTIONS

This section will include a detailed consideration of each of the five research questions, if and how the Figure-8 model applies to each, and the thought process involved in developing potential answers to the questions.

1. Are the IT educations received at civilian Advanced Civil Schooling institutions meeting the needs of the Functional Area 53?

To answer this question, a comparison between the IT curricula taught at the civilian ACS institutions and the FA53 task list is conducted. From the perspective of the Figure-8 model, this comparison occurs between steps 3 and 4, Identify Supporting Task List and Identify Training and Education, respectively. See Figure 14.

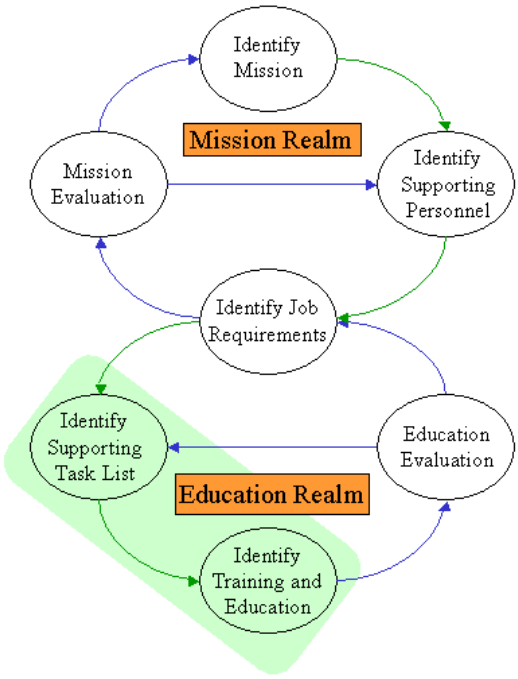

Figure 14. Compare IT Curricula

FA53 students can currently choose from over 90 colleges and universities to receive their IT degrees. However, not all institutions of higher learning have the same perspective as to what exactly constitutes a degree in IT. Appendix A lists all colleges and universities for which the Army will provide funding (PERSCOM, 2001), as well as the IT-related degree offered by each institution. Educations range in scope from a CIO Certificate, to a Master of Science degree, and include areas of emphasis such as Computer Information Systems (CIS), Management Information Systems (MIS), Information Architecture and Knowledge Management (IAKM), and Technical Management (TM), to name only some of the multitude of titles.

a. Task List to Curricula Comparison

The process used to determine which of these curricula meet FA53 education requirements is a two-step process. First, I classified each of the original 61 FA53 tasks under their perspective IT subcategory. This breakdown can be found in Appendix B. Each of the tasks falls under one of these 10 IT subcategories, making it an easier resource for direct comparison. The 10 IT subcategories are as follows:

- Programming and Software Systems
- Internet Application and Development
- Database Management Systems
- Technical Writing and Documentation
- Financial Management Functions
- Inter-Service and International Capabilities
- Information Systems Management
- Networking Technology, Hardware/Software/Operating Systems
- Information Security and Assurance
- Tactical Networks and Communications Systems

Second, I compared these 10 IT subcategories to the curricula of all the aforementioned colleges and universities in a spreadsheet format, which calculated a percentage of disciplines that each curricula addresses. For the sake of completion, I have also included the Fort Gordon School of Information Technology's curriculum in this comparison. A consolidated view of this research is in Appendix E.

Percent of subcategories addressed ranges from as low as 20 percent at Hawaii Pacific University and the Universities of Cincinnati, Montana, Central, and South Florida, to as high as 80 percent at Naval Postgraduate School and Towson State University. Most institutions range from 40 to 60 percent. Institutions that address 70 percent or more of the subcategories are as follows:

- Air Force Institute of Technology – 70 percent
  - Degree: Master of Science/Information Systems Management
  - Accreditation: Higher Learning Commission/North Central Association (HLC/NCA)
  - Location: Wright-Patterson Air Force Base, Ohio

- Naval Postgraduate School – 80 percent
  - Degree: Master of Science/Information Technology Management
  - Accreditation: American Assembly of Collegiate Schools of Business (AACSB)
  - Location: Monterey, California
- National Defense University – 70 percent
  - Certificate: DoD Chief Information Officer Certificate
  - Accreditation: None
  - Location: Fort McNair, Washington D.C.
- Towson State University – 80 percent
  - Degree: Master of Science/Applied Information Technology
  - Accreditation: AACSB
  - Location: Towson, Maryland
- University of Illinois/Chicago – 70 percent
  - Degree: Master of Business Administration/Information and Decision Sciences
  - Accreditation: AACSB
  - Location: Chicago, Illinois
- University of Iowa – 70 percent
  - Degree: Master of Management Information Systems
  - Accreditation: AACSB
  - Location: Iowa City, Iowa

The education offered by the National Defense University is not a degree program, rather a CIO certification program. With careful selection of courses, however, it could meet a substantial 70 percent of the FA53 requirements. Be reminded that the appearance of a civilian institution on this list does not necessarily mean that institution has what is considered to be one of the best IT curricula available. It only means that these curricula touch on the same subcategories that are required of a fully qualified FA53 officer. By presenting IT curricula from a DoD perspective, AFIT and NPS practically guarantee a high percent of subcategories addressed.

Some surprising finds from this research are the impressive showing by Towson State University with 80 percent of disciplines addressed, and the relatively poor showing by the Fort Gordon School of Information Technology, the primary FA53 training mechanism, with only 60 percent of subcategories addressed. To their credit,

however, the combined training time of the FA53 officer at Fort Gordon is only 30 weeks. Considering the short training period, there is a considerable amount of material covered. See Appendix C and D for School of Information Technology course outlines.

2. Does the current Information Technology Management curriculum at Naval Postgraduate School meet FA53 requirements, and if not, where is the shortfall?

To address this question, the same procedure will be used as in the previous question. A direct comparison of the IT curriculum at NPS to the 10 IT subcategories will give a good indicator of how well the current curriculum meets FA53 requirements. Again, as it relates to the Figure-8 Model, this comparison would occur between steps 3 and 4, Identify Supporting Task List and Identify Training and Education, respectively, as indicated in Figure 15.

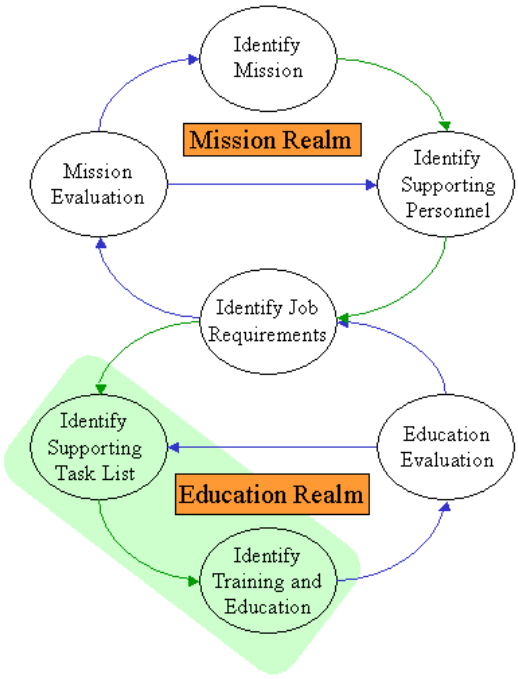

Figure 15. Compare NPS IT Curriculum

a. NPS Curriculum to IT Disciplines Comparison

Appendix E indicates that NPS meets 80 percent of the IT subcategories gleaned from the original FA53 task list. The two areas lacking are the areas of Inter-Service and International Capabilities and Tactical Networks and Communications Systems.

b. Analysis of the Inter-Service and International Capabilities Subcategory

The Inter-Service and International Capabilities subcategory is easier analyzed one section at a time. Inter-service aspects of IT are not directly addressed in the current curriculum at the NPS. This is not to say that such courses are not taught at the NPS. Course descriptions indicate that the following classes could satisfy the Inter-Service portion of this subcategory, and should be considered for inclusion in the updated curriculum.

- IS3112 Information Technology Management in DoD
- IS3181 Integrating and Leveraging Information Technologies
- IS3185 Management of Information Technology
- IS3504 Modern Network Operating Systems: Planning, Technology and Operations

International Capabilities from the IT perspective, however, are not addressed in any course currently taught at the NPS. The student does, however, have the option to take directed study courses, such as IS4800, *Directed Study in Advanced Information Systems* and can then specialize in any IT-related topic of relevance. This is, perhaps, one way of integrating international IT capabilities training into this degree without setting up an entire course devoted only to this topic.

c. Description of an IT Issues in Joint, Allied, and Coalition Forces Course

To more specifically address both of these subject areas, an IT Issues in Joint, Allied and Coalition Forces course could be developed and offered as an elective. Such a course would not only benefit Army FA53 students, but all NPS students whose curricula touch on some form of potentially Joint communications, and it is for this reason that the responsibility for developing such a course should rest with the NPS.

d. Analysis of the Tactical Networks and Communication Systems Subcategory

Likewise, the Tactical Networks and Communication Systems subcategory is easier analyzed in two pieces. Tactical Networks are not addressed in the current curriculum, although the argument could be made that there are enough

similarities between garrison and tactical computer networks that individually addressing the latter is hardly worth the effort. From the Navy's perspective this may be true. But from the Army's perspective, the tactical IT network is quickly becoming the base from which, and through which, all tactical information flows. Even what could classically be considered as standard communications systems are being designed with the concept of the automated battlefield in mind, and the line between communication system and tactical network is quickly starting to blur. Therefore, it is certainly worth an individual look. There are information systems and equipment that, while perhaps not unique to the Army, play an important role on the automated battlefield. Among them are the Standard Army Management Information System (STAMIS) and the integration of STAMIS with sustaining base systems, Battlefield Video Teleconference (BVTC) equipment and networks, and Command Post Audio-Visual (CPAV) components.

This knowledge of Tactical Networks rolls neatly into the bigger picture of Communication Systems, and it is here that the Army and Navy truly differ. Satellite and radio communications aside, there are little similarities in the communication needs of the Army and Navy. While a ship may be limited to wireless communications while at sea, the Army is still heavily dependent upon legacy wire-based communication systems. The Multiple Subscriber Equipment (MSE) communication system, although nearing the end of its lifecycle, is still the primary communications system in numerous Divisions, and while portions of this system utilize wireless technology, the complete system relies partially on the medium of wire as opposed to space. Additionally, the pace at which the automated battlefield is becoming a reality far exceeds the capability of the existing communications infrastructure to support the increased bandwidth requirement. On the unit level, this equates to increasing bandwidth capabilities in any way possible, imposing odd variations on the communications system through a variety of dataflow "band-aids" such as Commercial Off the Shelf (COTS) routers, resulting in no two communications systems that are exactly alike. Clearly this will have an impact on the IT structure that hangs off this communications system. It is not enough that the FA53 officer understands his or her computer network, but must also be able to temper that network, and the resulting expectations of that network, to the limitations imposed by the surrounding communications system.

While it is certainly worth mentioning that the NPS does offer a 3-course series of Communications Engineering (EO2514, EO3514, and EO4514 from the Department of Electrical and Computer Engineering), it should also be mentioned that this series does not address the practical application of the communications systems, rather the physical mathematical analysis of signal characteristics. See Appendix H for a detailed description of these courses. The NPS does, however, offer a consolidated Communications Engineering course, EO3502 *Telecommunications Systems Engineering,* which gives a broad overview of various communications systems and their characteristics. This consolidated version of the 3-part series addresses all forms of communication methods and mediums from twisted-pair to satellite. The EO3502 course would be of great assistance in providing the FA53 officer the necessary technical knowledge base of signals and their behavior, particularly if it was overlaid with a course on practical application of these signals in actual communications systems, physical limitations thereof, and atmospheric factors.

e. Description of an Army Communications Systems and Tactical Networks Course

The Army Communications Systems and Tactical Networks course should focus on practical application of the current and future communications systems used by the Army, their physical limitations, and the impact of atmospheric factors on the individual systems. Additionally, this course should provide detailed information on how to assess the existing communications system and configure the network to thrive under conditions of limited bandwidth, as well as how to prioritize the dataflow in a manner that enables successful fulfillment of mission requirements. Finally, the course should provide an overview of the STAMIS system and preferably hands-on training on Video Teleconferencing equipment. By nature of the fact that this course is Army-specific, it should therefore be developed and updated by the FA53 proponent.

f. An alternative to the Army IT Systems and Issues Course

As stated previously, the NPS student has the option to take Directed Study courses, such as IS4800 to fulfill individual educational requirements. The student is allowed to take more than one IS4800 course, as the need arises (NPS, 2000). The aforementioned Army Communications Systems and Tactical Networks course could be

developed by Fort Gordon as a directed study course, to be completed by the student during a directed study period, be it at the NPS or any other ACS institution.

3. Will an Army instructor be needed at Naval Postgraduate School to teach Army-specific courses?

Although more of a financial and political question, it could reasonably follow that if the Army FA53 education requires an Army-specific class be taught at the NPS, the instructor for this class should be provided by the Army. This is, however, an expensive request, and given that only 9 FA53 students per year are approved for the ACS program, providing an instructor at the NPS simply to teach Army courses may not be cost effective.

a. Other Duties of the Army Instructor

Army-specific instruction is not the only duty this officer could fulfill. He or she could serve in a number of specific duties, to include the following:

- Filling the role of career counselor to FA53 students at the NPS.
- Point of contact instructor for Army directed study courses.
- Liaison officer between the NPS and the FA53 proponent for curriculum updates.
- Liaison officer between the NPS Army IT students and the Student Detachment at Fort Gordon.
- Instructor for general courses or non-Army courses.
- Instructor for Military Education Level – 4 (MEL4) training at the NPS.
- Other potential duties as the senior Army officer at the NPS determines necessary.

b. The Message the Army Sends by Providing an Army IT Instructor

Providing an Army IT instructor to the NPS sends an unmistakable message of the Army's resolve on this issue to the staff and faculty at the NPS. By going to the expense of providing an Army Instructor to address FA53 curriculum needs, the Army clearly indicates their willingness to shoulder some of the educational expense in return for quality trained FA53 officers. Having an Army IT instructor on board also ensures the Army FA53 community has a knowledgeable and definitive voice in curriculum updates.

c. Benefits of the Army IT Instructor Position at the NPS

The Army IT position would be regarded as a "plum assignment" if for no other reasons than the location of the NPS, the decidedly decreased operational tempo (OPTEMPO), and the potential for extended family time. Designation of the Army IT Instructor position as an O-5 Joint billet would attract the best and brightest Army Lieutenant Colonel FA53 officers to compete for the assignment. This would ensure a high quality officer in the instructor position and create another Joint FA53 officer billet.

4. Is it possible to reduce the Army-specific curriculum schedule to 12 to 18 months and still meet currently identified Academic requirements for the degree?

Appendix G outlines a proposed curriculum and compares it to the 10 IT disciplines to ensure total compliance. The proposed curriculum is also an attempt to reduce the curriculum to 18 months. This curriculum totals 116 credit hours and extends for the duration of 18 months, not including the optional 12-week refresher quarter, as opposed to the current 24 month IT curriculum (Appendix F).

a. Differences Between the Current and Proposed Curricula at the NPS

The primary difference between the current and proposed IT curricula at the NPS is the elimination of the 3-course EO series. None of these courses are instrumental to the FA53 student, as indicated by the current FA53 task list. Additionally, the proposed curriculum includes the elimination of the following courses:

- MN2155 Accounting for Management
- PH3052 Sensor Technology and Application
- CC4221 C4ISR Systems
- NW3230 Strategy and Policy
- MN3154 Financial Management in the Armed Services

Elimination of these courses is necessary because they are either irrelevant or redundant in accordance with the 10 IT subcategories. To enhance this curriculum to better meet FA53 requirements, the following courses were added:

- CS3670 Secure Management of Systems

- EO3502 Communications Systems Technology and Application
- IS4800 Directed Study, Army Communications Systems and Tactical Networks

The MA1010 *Algebra and* Trigonometry and MO1901 *Mathematics for* ISSO courses were kept since they provide the lead in and training for Fourier Analysis, a necessary skill for successful completion of the EO3502 course.

One additional course taught by the NPS would be of great assistance in rounding out the IT curriculum, not only for Army students, but for students of all services.

1. A 4000-level IS course entitled *IT Issues in Joint, Allied, and Coalition Forces* to be taken as an elective. The IT Issues in Joint, Allied, and Coalition Forces course should focus on implementation of IT assets in all services and how they intend to fulfill their portion of future Joint visions, such as Joint Vision 2020. Special emphasis should be placed on understanding how these technologies can be integrated among the services, what efforts are being made to bring this integration to fruition, and the circumstances under which such integrations would occur. Additionally, the course should address the technological standing of Allied and Coalition forces, and their plans to further their IT posture.

b. Analysis of the 12 to 18 Month Objective

Reducing the curriculum to 18 months is possible, and the student will face a similar workload per quarter. The proposed 18-month curriculum in Appendix G indicates 116 total credit hours, 35 credit hours short of the previous 24-month curriculum (Appendix F). The student will find an even amount of hours over the course of this curriculum. The student will start with 12.5 hours during the refresher quarter, up sharply to 16 hours in the first quarter, peaking at 19 hours in the 2nd quarter. The hours will drop down to 18 in the 3rd quarter, rise back up to 18.5 hours in the 4th quarter, then level off with 16 hours for the 5th and 6th quarters. The workload is reasonable, and similar to that of students under the current curriculum. See Figure 16 for a graphical comparison of the workloads for both the current and proposed curriculum.

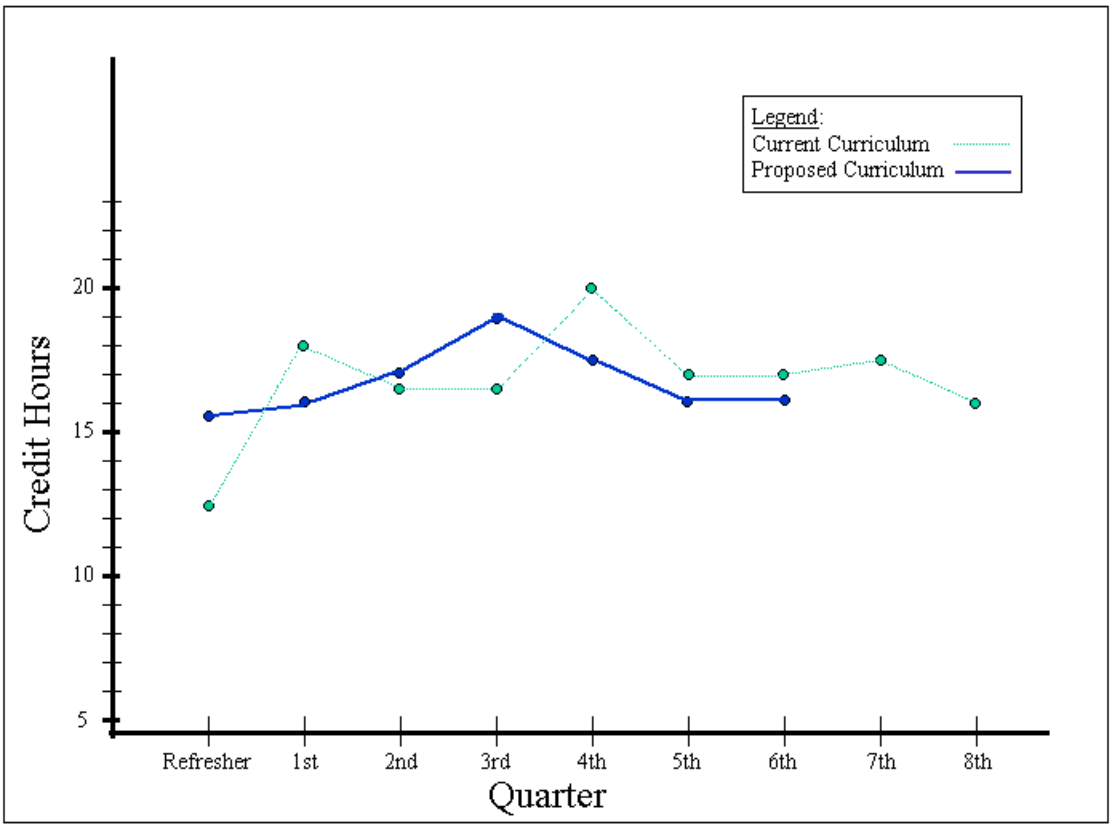

Figure 16. Graphic Comparison of IT Workloads

The curriculum workload in the proposed curriculum closely resembles that of the longer 24-month current curriculum. Reducing the curriculum to 12 months, however, poses the risk of eliminating classes that are needed to meet FA53 education requirements, potentially denying the student the well-rounded education expected of an ACS-educated FA53 officer.

c. Analysis of Academic Requirements Met

Academic requirements for this degree indicate the necessity for 52 graduate-level credit hours, 20 of which must be 4000-level courses. A graduate-level course is defined as any 3000- or 4000-level course. The proposed curriculum meets these requirements, with 84 graduate-level credit hours, 24 of which are 4000-level courses. Additional requirements include the completion of an acceptable thesis and the approval of the student's curricular program by the Chair, Information Systems Academic Group. In the fifth and sixth quarters, the student is allotted four thesis research blocks, the normal amount of thesis research blocks allotted to any IT student at

the NPS. The proposed ITM curriculum indicated in Appendix G has received initial approval by both the Academic Associate and Chairman, Information Systems Academic Group. The proposed schedule in Appendix G is a preliminary schedule. The final form of this schedule will depend on further detailed discussions with the Army Functional Area 53 proponent on content, the number of Army officers enrolled, and resourcing.

5. How should the Army-specific curriculum be updated and when should updates occur?

Updates to the Army-specific curriculum occur in the Figure-8 Model as a result of the Education Evaluation. By evaluating FA53 officers through a variety of evaluation tools, curriculum updates can be made based on how well the FA53 officer is able to perform his or her duties in the workplace. Figure 17 illustrates.

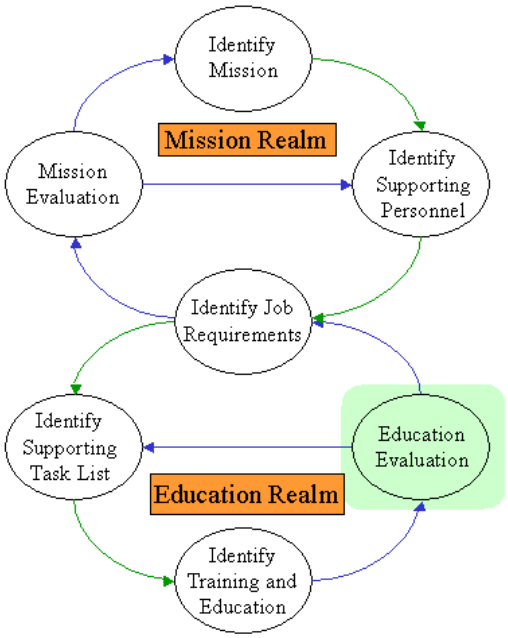

Figure 17. Education Evaluation

Updates to the curriculum should occur more often in a technology dependant functional area such as FA53, simply because of the constant turnover of technology and the tendency to incorporate Commercial Off the Shelf (COTS) automation equipment as soon as the unit can afford to buy it. A reasonable amount of time between updates is 2

years. As stated previously, however, and as could be implied by never ending cyclical depiction of the Figure-8 Model, the update to such a curriculum never really stops. The constant comparison of the Education Realm to the Mission Realm should be an ongoing process.

Those who should primarily determine curriculum updates are those individuals who have their finger on the pulse of not only the FA53 community, but also the Army from the mission perspective. The Hunt and Willhelm thesis mentioned in the Literature Review gives a good consolidated list of the key players who should be included in the curriculum update process. Referring to this group as a "focus group", the current list includes the following:

- Mr. Philip Sines – Chief Officer Division, United States Army Signal Center & Fort Gordon (USASC&FG)
- Mr. Pete Phelps – Training/Force Integration, USASC&FG
- MAJ Alan Makowski – Functional Area 53, USASC&FG
- MAJ Kendall Polk – Chief, Officer Training Division
- LTC Jody Draves – Functional Area 53 Branch Chief
- MAJ Scott Barrington – FA53 Field Grade Assignments Officer
- CPT Mike Corpening – FA53 Company Grade Assignments Officer
- LTC Jody Draves – Branch Chief Information Operations Career Field

The personnel from the NPS that should be included in this update are the following:

- Professor George Conner, Chairman, Department of Information Sciences
- Professor Dan Boger – Academic Associate, Information Systems and Technology Curriculum
- CDR Chris Lapacik, Curricular Officer, Information Systems and Technology Curriculum
- Army IT Instructor

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IV. FINDINGS AND RECOMMENDATIONS

This section will recap previous research with a consolidated statement of findings and suggested action.

A. CONSOLIDATED KEY FINDINGS

1. Training the Functional Area 53 Officer through Advanced Civil Schooling

Given the expense involved in training a FA53 officer at an ACS institution, certainly the quality of education the officer receives should be of paramount importance. As indicated in Appendix E, not all IT curricula are created equal. Some institutions address only 20 percent of the subcategories a FA53 officer is expected to understand and be able to apply. During this research, however, six institutions displayed curricula that meet at least 70 percent of FA53 requirements. Those institutions include:

- Air Force Institute of Technology
- Naval Postgraduate School
- National Defense University
- Towson State University
- University of Illinois/Chicago
- University of Iowa

These institutions should be the only ACS institutions considered for IT educations, unless future research indicates that the remaining institutions have modified their curriculum in a way that meets a greater percent of FA53 education requirements.

2. Functional Area 53 Education at the Naval Postgraduate School

The NPS already offers a strong IT curriculum with the added benefit of having a decidedly Department of Defense slant. As the curriculum stands, it addresses 80 percent of the subcategories required of a FA53 officer, and with the addition of one directed study course and one requested NPS course, could easily address 100 percent of these disciplines. FA53 students selected for ACS should be encouraged to attend the NPS for their IT educations. The NPS is willing and able to engage in periodic updates of the curriculum to match changes in technology and Army mission, resulting in FA53 officers that have the most current and thorough educations available.

Another added benefit to regularly sending Army officers to a Navy school is their exposure to officers from the sister services and foreign countries. The NPS, while naturally maintaining a high percent of Naval officers, also educates numerous Marine Corps officers and a wide range of foreign officers. Spending an extended period of time in the presence of these officers in an academic environment will increase the Army officer's awareness and understanding of his or her sister services and allies, knowledge that will benefit that officer in future Joint assignments.

Conversely, Army officers bring a different perspective to the table as well. The intricate operations of an inherently ground force is as foreign to a Navy officer as driving a ship would be to an Army officer. Exposure to this perspective has a similar impact on Navy and Marine Corps officers, in that their understanding of the Army will increase, making them more effective decision makers in the Joint forces arena.

3. Army IT Instructor at Naval Postgraduate School

Placing a knowledgeable senior Army IT instructor, preferable a seasoned FA53 officer, onto the existing Army staff at the NPS is imperative to ensure quality Army-specific instruction and recognition of Army needs during periodic curriculum updates. The willingness of the Army FA53 community to extend the kind of effort and financial backing needed to support this billet also speaks volumes about the Army's resolve concerning the ACS FA53 officer training issue.

The primary duty of the Army IT instructor at the NPS would be to teach Army-specific IT courses. As indicated in Chapter III, however, there are also many other duties the Army IT instructor could fulfill in addition to Army-specific IT training.

4. The 18-Month Army-Specific IT Curriculum

As indicated in Appendix G, the proposed 18-month Army-specific IT curriculum is of an equivalent workload to that of the current curriculum, and has met the approval of the Chairman and Academic Associate of the Information Systems Academic Group at the NPS. The original curriculum from which this curriculum was developed follows a logical continuum from basic to advanced computer and automation training but does not present any one course that is overwhelming in its scope or depth. Students with an undergraduate degree in Computer Science or Computer Information Systems will find

much of the first two to three quarters to be somewhat of a rehash, as these quarters are an update of their undergraduate education. Students cover topics such as Object Oriented programming, database management, network configuration, and computer security. The policy of the NPS is to validate such coursework for the knowledgeable officer.

Aside from the proposed changes to the curriculum to both eliminate courses that are irrelevant to the FA53 officer and add courses that will be of benefit to the FA53 officer, other modifications to the curriculum include the addition of one directed study course that is Army specific. This is the Army Communications Systems and Tactical Networks course. This course should be developed and updated by the School of Information Technology at Fort Gordon, and included in the student's curriculum during the fourth quarter. This course should not be limited to only NPS students. Of particular importance to the FA53 officer in the field environment is the understanding of the surrounding communications systems, which the directed study course on Army Communications Systems and Tactical Networks attempts to explain. This course could be included in the curriculum at the School of Information Technology at Fort Gordon, as well as to other ACS institutions that allow for directed study in their curricula. The proposed curriculum can be found in Appendix G.

5. Updating the Army-Specific IT Curriculum

The Army-specific curriculum should be updated at a minimum of every two years. As per the Figure-8 Model, an Education Evaluation should be conducted to determine if the Job Requirements and Supporting Task List are still current. There are many ways in which to do this, such as surveying FA53 officers at various points throughout their careers to ascertain their ability to comply with the demands of their jobs.

Updates to the Army IT curriculum should conducted by a dedicated team or focus group as indicated in Chapter III. Also, academic advisors from the NPS should be actively involved in the updating process to ensure Army requests are in compliance with academic requirements and within the capabilities of the NPS.

B. SUGGESTED FURTHER STUDIES

The following topics are related to this thesis and indicate the potential for further study:

- Describe in detail the process for updating the Army-specific IT curriculum.
- Further develop the concept of the Figure-8 Model.
- Develop an IT training model specifically designed for the Army Functional Area 53.
- Consider the impact of adding the Army Military Education Level 4 (MEL4) training in with this curriculum.
- Consider the possibility of a Joint Information Technology training model and curriculum, with individual areas of emphasis for each service.
- Consider the possibility of establishing Naval Postgraduate School as the Joint Information Technology training facility for the Department of Defense.

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APPENDIX A. ADVANCED CIVIL SCHOOLING OPTIONS FOR FUNCTIONAL AREA 53 STUDENTS AND DEGREES OFFERED (PERSCOM, 2001)

Institution	Degree Offered
Air Force Institute of Technology	MS-ISM
Arizona State University	MBA-IT or MS-IT
Arkansas State University	MBA-IS
Auburn University	MMIS
Ball State University*	MBA-IS
Baylor University*	MBA or MS-IS
Brigham Young University	MISM
California State University, Fullerton*	MS-IS
California State University, San Bernadino*	MBA-IS
Central Michigan University*	MS-IS
College of William and Mary	MBA-IS
Colorado State University	MS-CIS
Florida State University	MSM-MIS
George Mason University	MBA-ISM
Hawaii Pacific University*	MS-IS
Iowa State University*	MS-IS
Kansas State University	MS-CIS
Kent State University	MS-IAKM
Long Island University, Brooklyn*	MBA-MIS
Louisiana State University	MS-ISDS
Marshall University	MS-IS
Miami University	MBA-MIS
Middle Tennessee State University	MS-IS
Mississippi State University	MS-IS
Naval Postgraduate School*	MS-IST
National Defense University	DoD-CIO Cert.
New Mexico State University	MBA-BCS
Northern Illinous University	MS-MIS
Ohio State University	MBA-MIS
Oklahoma State University	MS-MIS
Pennsylvania State University*	MBA-IT
Rice University*	MBA-IT
Rutgers University*	MBA-MSIS
San Diego State University*	MBA-IS
Seattle University*	MBA-ECIS
Shippensburg University	MS-IS
Southern Illinois University, Edwardsville	MS-CIS
Southwest Missouri State University	MS-CIS
State University of New York, Utica	MS-CIS
State University of New York, Buffalo	MBA-ISEB

State University of New York, Stony Brook	MS-ISM
State University of New York, Paltz	MBA-IKM
Tarleton State University	MBA-CIS
Temple University*	MBA-MIS
Texas A&M University	MS-MIS
Texas Tech University	MBA-MIS
Townson State University	MS-AIT
University of Alabama*	MBA-MIS
University of Arizona	MS-MIS
University of Arkansas	MS-ITM
University of Baltimore*	MS-MIS
University of Central Florida	MBA-ISM
University of Central Texas	MBA-IM
University of Cincinnati	MBA-IS
University of Colorado, Colorado Springs	MBA-IS
University of Colorado, Denver	MS-IS
University of Delaware	MBA-IT
University of Florida	MS-DIS
University of Houston	MBA-DISC
University of Illinois, Chicago	MBA-IDS
University of Iowa*	MMIS
University of Kansas	MS-BIS
University of Kentucky*	MS-DSIS
University of Maine*	MSIS
University of Maryland*	MBA-IT
University of Montana	MS-TC
University of New Mexico	MBA-MIS
University of South Dakota	MBA-MIS
University of South Florida	MS-MIS
University of Southern Maine*	MS-CS
University of Southern Mississippi	MBA-MIS
University of Tennessee, Chattanooga	MBA-MIS
University of Texas, Arlington	MS-IS
University of Texas, Austin	MBA-MSIS
University of Texas, El Paso	MBA-CIS
University of Virginia	MS-MIS
University of Washington	MBA-TM
University of Wisconsin, Madison	MBA-ISAD
Utah State University	MS-BIS
Villanova University*	MBA-DIT
Virginia Commonwealth University	MS-IS
Virginia Polytechnic Institute	MBA-MSIT
Webster University	MA-CRIM
Western Michigan University	MBA-CIS
Wright State University	MBA-MIS

*Mid-cost school, $8,501-$14,500/year

Legend

AIT: Applied Information Technology
BCS: Business Computer Systems
BIS: Business Information Systems
CIS: Computer Information Systems
CRIM: Computer Resources and Information Management
CS: Computer Science
DIS: Decision and Information Sciences
DISC: Decision and Information Sciences
DIT: Decision and Information Technology
DoD-CIO Cert: Department of Defense Chief Information Officer Certificate
DSIS: Decision Science and Information Systems
ECIS: E-Commerce and Information Systems
IAKM: Information Architecture and Knowledge Management
IDS: Information and Decision Sciences
IKM: Information and Knowledge Management
IS: Information Systems
ISAD: Information Systems Analysis and Design
ISDS: Information Systems and Decision Sciences
ISEB: Information Systems and E-Business
ISM: Information Systems Management
IST: Information Systems Technology
IT: Information Technology
MA: Master of Arts
MBA: Master of Business Administration
MIS: Management of Information Systems
MISM: Master of Information Systems Management
MMIS: Master of Management Information Systems
MS: Master of Science
MSIS: Management Science and Information Systems
MSIT: Management Science and Information Technology
MSM: Master of Science in Management
TC: Technical Communications
TM: Technical Management

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APPENDIX B. TASKS SUBCATEGORIZED INTO DISCIPLINES (POLK, 2001)

Programming and Software Systems

113-404-4002(P)	Direct the Installation of Software on an Automated Information System (AIS)
113-407-4005(P)	Direct the Installation of Software on Networking Devices
113-493-4011(P)	Write Programs to Automate Routine Tasks

Internet Application Development

113-493-4003(P)	Design Web-Based Applications
113-493-4007(P)	Implement a Web-Based Application

Database Management Systems

113-406-4001(P)	Design a Database Management System (DBMS)
113-406-4002(P)	Implement a Database Management System (DBMS)
113-406-4003(P)	Maintain a Database Management System (DBMS)

Technical Writing and Documentation

113-365-4001(P)	Write the Information Technology (IT) Portion of an Operations Order (OPORD), an Operations Plan (OPLAN), or a Fragmentary Order (FRAGO)
113-405-4001(P)	Develop Information Technology (IT) Policies and Procedures
113-405-4005(P)	Prepare a Unit Automation Plan
113-446-4001(P)	Identify the Data Communications Techniques Used Within a Tactical Communications System
113-460-4001(P)	Design Messaging Architecture
113-467-4001(P)	Develop Information Technology (IT) Training Plan
113-493-4006(P)	Evaluate Hardware/Software System Specifications
113-509-4001(P)	Define User Information Technology (IT) Requirements
113-510-4003(P)	Write a Continuity of Operations Plan (COOP)

Financial Management Functions

113-405-4002(P)	Implement Acquisition Plan for Information Technology (IT) Assets
113-419-4001(P)	Review Technical Proposals from Contractors
113-420-4001(P)	Review Requests for Proposal (RFP) for Contract Solicitation

Inter-Service and International Capabilities

113-438-4001(P)	Connect Information Technology (IT) Systems to Allied, Host Nation, Joint, and Nongovernmental Agencies

Information Systems Management

113-405-4001(P)	Implement Information Technology (IT) Training Plan
113-405-4004(P)	Implement a Maintenance Plan for Information Technology (IT) Assets
113-510-4001(P)	Conduct a Site Survey
113-510-4002(P)	Develop an Accreditation Plan for an Automated Information System (AIS)

Networking Technology, Hardware/Software/Operating Systems

113-398-4001(P)	Design System Architecture Based on Operational Requirements
113-398-4002(P)	Implement System Architecture Based on Operational Requirements
113-403-4001(P)	Perform Configuration Management
113-404-4001(P)	Direct the Installation of an Automated Information System (AIS)
113-407-4001(P)	Design a Local Area Network (LAN)/Wide Area Network (WAN)
113-407-4002(P)	Direct the Correction of a Local Area Network (LAN) Malfunction
113-407-4003(P)	Configure a Local Area Network (LAN) to Interface with a Wide Area Network (WAN)
113-407-4004(P)	Direct the Installation of a Local Area Network (LAN)/Wide Area Network (WAN)
113-407-4006(P)	Configure Network Management Systems
113-407-4007(P)	Optimize Network Performance
113-407-4008(P)	Perform Network Management for Local Area Networks (LAN)/Wide Area Networks (WAN)
113-407-4009(P)	Configure Network Servers
113-463-4001(P)	Connect Tactical Wide Area Network (WAN) to the Defense Integrated Services Network (DISN)
113-463-4003(P)	Modify Router Configurations
113-463-4004(P)	Optimize Router Configurations
113-464-4001(P)	Install System Hardware
113-493-4001(P)	Correct a Malfunction on an Automated Information System (AIS)
113-493-4002(P)	Configure an Automated Information System
113-493-4004(P)	Determine Cable Interface Specifications
113-493-4008(P)	Optimize Automated Information Systems (AIS)
113-493-4009(P)	Optimize Servers
113-493-4010(P)	Perform System Administration Functions
113-493-4012(P)	Configure Servers

Information Security and Assurance

113-397-4001(P)	Design Network Encryption System (NES) Network
113-397-4001(P)	Design Network Security Architecture for Information Assurance (IA)
113-473-4002(P)	Implement Network Security Architecture for Information Assurance (IA)
113-473-4003(P)	Configure a Network Encryption System (NES) Network

113-473-4004(P)	Maintain Network Security Architecture for Information Assurance (IA)

Tactical Networks and Communications Systems

113-437-4001(P)	Design Battlefield Video Teleconference (BVTC) and Video Teleconference (VTC) Network
113-449-4001(P)	Direct the Installation of Command Post (CP) Audio-Visual (AV) Components
113-460-4002(P)	Maintain Standard Army Management Information Systems (STAMIS)
113-460-4003(P)	Configure Standard Army Management Information Systems (STAMIS)
113-462-4001(P)	Direct the Installation of Battlefield Video Teleconference (BVTC) and Video Teleconference (VTC) Network
113-463-4002(P)	Interface Tactical Standard Army Management Information Systems (STAMIS) with Sustaining Base Systems
113-486-4001(P)	Manage an Internet Protocol (IP) Data Network (Tactical Internet)
113-493-4005(P)	Direct the Installation and Configuration of Messaging Components

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APPENDIX C. INFORMATION SYSTEMS OPERATIONS LEVELER (ISOL) COURSE DESCRIPTION

Course Location: Fort Gordon, Georgia, School of Information Technology

Course Number: 7E-F70

Purpose: This training is mandatory prior to attending the FA24A AOC or the FA53 AOC producing course. Training will provide students with a working knowledge of Signal systems, architectures and common information technology principles.

Total Course Length (Including weekends, in- and out-processing): 10 weeks

Academic Hours: 385 hours

Course Summary:

SUBJECT	DAYS
Hardware	2
Operating Systems	1
Cisco Academy 1st Semester	7
Cisco Academy 2nd Semester	7
Windows NT 4.0	7
Introduction to Unix	3
IASO Security Course	0
Total Days	**27**

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APPENDIX D. INFORMATION SYSTEMS MANAGEMENT (ISM) COURSE DESCRIPTION

Course Location: Fort Gordon, Georgia, School of Information Technology

Course Number: 7E-53A

Purpose: To train personnel in the skills and knowledge needed to perform the duties of a systems automation management officer.

Total Course Length (including weekends, in- and out-processing): 19 weeks, 4 days

Academic Hours: 776 hours

Course Summary:

SUBJECT	DAYS
Cisco Academy, 3rd Semester	8
Cisco Academy, 4th Semester	8
NT Enterprise 4.0	5
Exchange Server 5.5	5
Introduction to Tactical Networking Design	1
VTC/BVTC Design Fundamentals	1
Solaris Administration	5
System Administrator/ Network Manager Security	10
Systems Analysis/ Design	5
SQL Syntax	3
Database Design & Development	11
Programming Logic	3
Programming w/ VB 6.0	15
Web Design & ASP	15
Seminars (Flexible Days)	2
TOTAL	**97**

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APPENDIX E. COMPARISON OF IT DISCIPLINES TO ADVANCED CIVIL SCHOOLING CURRICULA

	Standards										
Universities	Programming and Software Systems	Internet Application Development	Database Management Systems	Technical Writing and Documentation	Financial Management Functions	Inter-Service and International Capabilities	Information Systems Management	Networking Technology, HW/SW/OS	Communication Security and Assurance	Tactical Networks and Communications Systems	"Best Case" Scenario Percentage of Disciplines Addressed
PERFECT	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**Y**	**100%**
Ft. Gordon School of IT	**Y**	**Y**	**Y**	**N**	**N**	**N**	**N**	**Y**	**Y**	**Y**	**60%**
Air Force Institute of Technology	Y	N	Y	Y	Y	N	Y	Y	Y	N	70%
Arizona State U.	Y	N	Y	N	Y	N	Y	Y	Y	N	60%
Arkansas State U.	Y	N	Y	N	Y	N	Y	N	N	N	40%
Auburn U.	Y	N	Y	N	Y	N	Y	Y	Y	N	60%
Ball State U.	N	N	Y	N	Y	N	Y	Y	N	N	40%
Baylor U.	N	N	Y	N	Y	N	Y	Y	N	N	40%
Brigham Young U.	Y	Y	N	N	N	N	Y	Y	N	N	40%
California State U./Fullerton	N	N	Y	N	Y	N	Y	Y	Y	N	50%
California State U./San Bernadino	N	N	Y	N	Y	N	Y	Y	N	N	40%
Central Michigan U.	Y	N	Y	N	N	N	Y	Y	Y	N	50%
College of William and Mary	Y	Y	Y	N	Y	N	Y	Y	N	N	60%
Colorado State U.	Y	Y	Y	N	Y	N	Y	Y	N	N	60%
Florida State U.	N	N	Y	N	N	N	Y	Y	N	N	30%
George Mason U.	N	N	N	N	Y	Y	Y	N	N	N	30%
Hawaii Pacific U.	N	N	N	N	Y	N	Y	N	N	N	20%
Iowa State U. of Science and Tech.	Y	N	N	N	Y	N	Y	N	N	N	30%
Kansas State U.	Y	N	Y	N	N	N	Y	Y	Y	N	50%
Kent State U.	Y	Y	Y	N	N	N	Y	Y	Y	N	60%
Long Island U./Brooklyn	Y	Y	Y	N	Y	N	Y	N	N	N	50%
Louisana State U.	N	Y	Y	N	Y	N	Y	N	N	N	40%
Marshall U.	Y	N	Y	N	N	N	N	Y	Y	N	40%
Miami U.	N	N	Y	N	Y	N	Y	N	N	N	30%
Middle Tennessee State U.	Y	N	Y	N	Y	Y	Y	N	N	N	50%
Mississippi State U.	Y	Y	Y	N	N	N	Y	Y	N	N	50%
Naval Postgraduate School	Y	Y	Y	Y	Y	N	Y	Y	Y	N	80%
National Defense University	N	Y	Y	N	Y	Y	Y	Y	Y	N	70%
New Mexico State U.	Y	Y	Y	N	Y	N	Y	Y	N	N	60%
Northern Illinois U.	N	N	Y	N	Y	N	Y	N	Y	N	40%
Ohio State U.	Y	N	Y	N	Y	N	Y	Y	N	N	50%

Oklahoma State U.	Y	Y	Y	N	Y	N	Y	Y	N	N	60%
Pennsylvania State U.	\	\	\	\	\	\	\	\	\	\	0%
Rice U.	N	N	Y	N	Y	Y	Y	N	N	N	40%
Rutgers U.	N	N	Y	N	Y	N	Y	Y	Y	N	50%
San Diego State U.	N	N	N	N	Y	N	Y	N	N	N	20%
Seattle U.	Y	Y	Y	N	Y	N	N	N	N	N	40%
Shippensburg U.	Y	Y	Y	N	N	N	Y	Y	N	N	50%
Southern Illinois U.	Y	N	Y	N	N	N	Y	Y	Y	N	50%
Southwest Missouri State U.	Y	N	Y	N	Y	N	Y	Y	N	N	50%
State U. of New York/Utica	Y	N	Y	Y	N	N	N	Y	Y	N	50%
State U. of New York/Buffalo	N	N	N	N	Y	Y	Y	N	N	N	30%
State U. of New York/Stony Brook	Y	N	Y	N	Y	N	Y	Y	N	N	50%
SUNY College/New Paltz	N	Y	N	N	Y	Y	Y	N	N	N	40%
Tarleton State U.	Y	N	N	N	Y	N	Y	Y	N	N	40%
Temple U.	Y	Y	Y	N	Y	N	Y	Y	N	N	60%
Texas A&M U.	N	Y	Y	N	Y	N	Y	Y	Y	N	60%
Texas Tech. U.	N	N	N	N	Y	Y	Y	Y	N	N	40%
Towson State U.	Y	Y	Y	Y	Y	N	Y	Y	Y	N	80%
U. of Alabama	\	\	\	\	\	\	\	\	\	\	0%
U. of Arizona	Y	N	N	N	Y	N	Y	Y	N	N	40%
U. of Arkansas	Y	N	N	N	Y	N	Y	Y	N	N	40%
U. of Baltimore	Y	N	N	N	Y	N	Y	Y	N	N	40%
U. of Central Florida	N	N	N	N	Y	N	Y	N	N	N	20%
U. of Central Texas	N	Y	Y	N	Y	N	Y	Y	N	N	50%
U. of Cincinnati	N	N	N	N	Y	N	Y	N	N	N	20%
U. of Colorado/Colorado Springs	Y	N	N	N	Y	N	Y	Y	N	N	40%
U. of Colorado/Denver	Y	N	N	Y	Y	N	Y	Y	N	N	50%
U. of Delaware	N	Y	Y	N	Y	N	Y	N	N	N	40%
U. of Florida	Y	N	N	N	Y	N	Y	Y	N	N	40%
U. of Houston	Y	N	Y	N	Y	Y	Y	N	N	N	50%
U. of Illinois/Chicago	Y	Y	Y	N	Y	N	Y	Y	Y	N	70%
U. of Iowa	Y	Y	Y	N	Y	N	Y	Y	Y	N	70%
U. of Kansas	N	N	Y	N	Y	N	Y	Y	N	N	40%
U. of Kentucky	Y	N	N	N	Y	N	Y	Y	N	N	40%
U. of Maine	Y	N	N	N	Y	N	Y	Y	Y	N	50%
U. of Maryland	Y	Y	Y	N	Y	N	Y	Y	N	N	60%
U. of Montana	N	N	N	Y	Y	N	N	N	N	N	20%
U. of New Mexico	N	N	N	N	Y	N	Y	Y	N	N	30%
U. of South Dakota	N	N	N	N	Y	N	Y	Y	N	N	30%
U. of South Florida	N	N	N	N	N	N	Y	Y	N	N	20%
U. of Southern Maine	Y	Y	Y	N	N	N	N	Y	N	N	40%
U. of Southern Mississippi	Y	N	N	N	Y	N	Y	Y	N	N	40%
U. of Tennessee/Chattanooga	N	N	N	N	Y	N	Y	Y	N	N	30%
U. of Texas/Arlington	N	N	N	N	Y	N	Y	Y	N	N	30%
U. of Texas/Austin	\	\	\	\	\	\	\	\	\	\	0%
U. of Texas/El Paso	N	N	N	N	Y	N	Y	Y	N	N	30%
U. of Virginia	N	Y	Y	N	Y	N	Y	Y	N	N	50%

U. of Virginia/Charlottesville	\	\	\	\	\	\	\	\	\	\	0%
U. of Washington	N	Y	Y	N	Y	Y	Y	N	N	N	50%
U. of Wisconson/Madison	N	N	N	N	Y	N	Y	Y	Y	N	40%
Utah State U.	Y	Y	Y	N	Y	N	Y	Y	N	N	60%
Villanova U.	N	Y	Y	N	N	N	Y	Y	N	N	40%
Virginia Commonwealth U.	Y	N	N	N	Y	N	Y	Y	Y	N	50%
Virginia Polytechic Institute	Y	Y	Y	N	N	N	Y	Y	N	N	50%
Webster U.	N	Y	Y	N	Y	N	Y	Y	Y	N	60%
Western Michigan U.	N	N	N	N	Y	N	Y	Y	N	N	30%
Wright State U.	N	N	N	N	Y	N	Y	Y	N	N	30%
Percent That Teach This Subject:	53%	34%	60%	7%	78%	10%	89%	72%	26%	1%	

Legend:
Low-Cost Schools (<=$8,500)
Mid-Cost Schools ($8,501-$14,500)
\: No curriculum info on website

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APPENDIX F. COMPARISON OF IT SUBCATEGORIES TO CURRENT NPS CURRICULUM

		Subcategories										
Courses for Current Curriculum	Classroom and Lab hours	Programming and Software Systems	Internet Application Development	Database Management Systems	Technical Writing and Documentation	Financial Management Functions	Inter-Service and International Capabilities	Information Systems Management	Networking Technology, HW/SW/OS	Information Security and Assurance	Tactical Networks and Communications Systems	**No Subcategories Addressed**
12-week refresher (Winter/Summer)												
MA1010, Algebra and Trigonometry	5											**X**
MN2155, Accounting for Management	4					X						
IS2000, Intro to Info. Technology Management	3.5		X					X				
Total hours	12.5											
1st Quarter (Fall/Spring)												
NW3230, Strategy and Policy	5											**X**
IS2020, Intro to Visual Basic	4.5	X										
CS3030, Computer Arch. and Operating Sys.	4				X			X	X			
OS3105, Statistics for Technical Management	4.5					X						
Total hours	18											
2nd Quarter (Winter/Summer)												
IS3020, Software Design	4	X										
IS3201, Fundamentals of Database Technology	4			X								
IS3502, Computer Networks: LAN/WAN	4								X	X		
OS3004, Operations Research for Computer Sys.	4.5					X		X				
Total hours	16.5											
3rd Quarter (Fall/Spring)												
MO1901, Mathematics for ISSO	3											**X**
CC3000, Intor to C4I Systems in DoD	4						X					
IW3101, Principles of Information Operations	4.5							X		X		
CS3600, Intro to Computer Security	5								X	X		
Total hours	16.5											
4th Quarter (Winter/Summer)												
MN4125, Managing Change in Complex Org.	4							X				
IS3172, C4ISR Systems Evaluation	4							X				
SS3011, Space Technology and Application	3						X		X		X	
EO2514, Intro to Commo Systems Eng. for ITM	5											**X**
IS3301, Fund. of Decision Support Systems	4		X		X			X				
Total hours	20											
5th Quarter (Fall/Spring)												
EO3514, Communications Systems I	5											**X**
PH3052, Sensor Technology and Application	4											**X**
IS4031, Principles of Info. Systems Evaluation	4				X				X			
IS4300, Software Engineering and Management	4	X										

Total hours	17											
6th Quarter (Winter/Summer)												
EO4514, Communications Systems II	5											**X**
IS4220, Architecting Information Systems	4							X	X	X	X	
IS0810, Thesis Research	4											
Elective	4											
Total hours	17											
7th Quarter (Fall/Spring)												
MN3154, Financial Mgt. in the Armed Services	4					X						
MN3331, Acquisition and Project Management	5.5					X						
CC4221, C4ISR Systems	4							X				
IS0810, Thesis Research	4											
Total hours	17.5											
8th Quarter (Winter/Summer)												
IS4182, Capstone Course	4							X				
IS0810, Thesis Research	4											
IS0810, Thesis Research	4											
Elective	4											
Total hours	16											
Entire Task Addressed:		Y	Y	Y	Y	Y	N	Y	Y	Y	N	N/A

Total Hours for Curriculum **151**

APPENDIX G. COMPARISON OF IT SUBCATEGORIES TO PROPOSED NPS CURRICULUM

		Subcategories										
Courses for Proposed Curriculum	Classroom and Lab Hours	Programming and Software Systems	Internet Application Development	Database Management Systems	Technical Writing and Documentation	Financial Management Functions	Inter-Service and International Capabilities	Information Systems Management	Networking Technology, HW/SW/OS	Information Security and Assurance	Tactical Networks and Communications Systems	**No Subcategories Addressed**
12-week refresher (Winter/Summer)												
CS3030, Computer Arch. and Operating Sys.	4				X			X	X			
MA1010, Algebra and Trigonometry	5											**X**
IS2000, Intro to Info. Tech. Management	3.5		X					X				
Total hours	12.5											
1st Quarter (Fall/Spring)												
IS2020, Intro. to VB (Object Oriented)	4.5	X										
CC3000, Intro. To C4I Systems in DoD	4						X					
OS3105, Statistics for Technical Management	4.5					X						
MO1901, Mathematics for ISSO	3											**X**
Total hours	16											
2nd Quarter (Winter/Summer)												
EO3502, Commo. Sys. Tech. and Application	3										X	
IS3020, Software Design	4	X										
MN4125, Managing Change in Complex Org.	4							X				
IS3201, Fundamentals of Database Tech.	4			X								
IS3502, Computer Networks: LAN/WAN	4								X	X		
Total hours	19											
3rd Quarter (Fall/Spring)												
MN3331, Acquisition and Project Management	5.5				X	X						
IS4300, Software Eng. and Management	4	X										
IW3101, Principles of Info. Operations	4.5							X	X	X		
IS3301, Fund. of Decision Support Systems	4		X		X			X				
Total hours	18											
4th Quarter (Winter/Summer)												
OS3004, Ops. Research for Computer Sys.	4.5					X		X				
CS3600, Intro to Computer Security	5								X	X		
IS4800, Army Commo Sys. And Tact. Net.*	4						X	X	X	X	X	
SS3011, Space Tech. and Application	3						X		X		X	
IS3172, C4ISR Systems Evaluation	2					X	X	X				
Total hours	18.5											
5th Quarter (Fall/Spring)												
CS3670, Secure Management of Systems	4									X		
IS4031, Principles of Info. Sys. Evaluation	4				X				X			
IS0810, Thesis Research	4											

IS0810, Thesis Research	4											
Total hours	16											
6th Quarter (Winter/Summer)												
IS4182, Capstone Course	4		X				X	X				
IS4220, Architecting Info. Systems	4							X	X	X	X	
IS0810, Thesis Research	4											
IS0810, Thesis Research	4											
Total hours	16											
Entire Task Addressed:		Y	Y	Y	Y	Y	Y	Y	Y	Y	Y	

Total Hours for Curriculum **116**

Total Graduate Hours (3000- and 4000-level) 84

Total 4000-level Hours 24

APPENDIX H. NAVAL POSTGRADUATE SCHOOL COURSE DESCRIPTIONS

Command, Control, Communications, Computers and Intelligence (C4I) Courses

CC3000 ***Introduction to C4I Systems in Department of Defense (4-0)*** Knowledge of current C4I systems and practice is introduced. A basic framework for understanding C4I is provided. Case studies are used as well as lessons learned from crises, field exercises and war-gaming. PREREQUISITES: Enrollment in the Joint C4I systems curriculum, OS2103 concurrently, and SECRET clearance.

CC4221 ***C4ISR Systems (4-0)*** (no course description)

CC4750 ***Military C4I Systems and Networks (3-1)*** By means of case studies of tactical and strategic military C4I systems, student familiarity is developed concerning system aspects such as network architecture, joint and combined interoperability, measures of performance, and vulnerability to ECM. Models and simulations in current use by DoD are used to determine the operational constraints imposed on the commander by system technical parameters, including environmental factors, under both limited objective and major combat scenarios. A required course for the 365 curriculum. PREREQUISITES: EO3523 (may be concurrent) or equivalent, and SECRET clearance.

Computer Science Courses

CS3030 ***Computer Architecture and Operating Systems (4-0)*** This course, designed for non-computer science majors, provides an overview of basic computer hardware concepts and operating systems software. The following topics are covered: basic computer concepts; data representation; elements of computer architecture and operation; processor and process management; multiprogramming; memory management; and file management. Future trends in computer hardware and operating systems will be discussed. PREREQUISITE: CS2971 or consent of instructor.

CS3310 ***Artificial Intelligence (4-1)*** Survey of topics and methods of Artificial Intelligence. Methods include rule-based systems, heuristic search and exploitation of natural constraints, means-ends analysis, semantic networks, and frames. Emphasis is placed on solving problems that seem to require intelligence rather than attempting to simulate or study natural intelligence. Projects to illustrate basic concepts are assigned. PREREQUISITES: CS3010 or consent of instructor.

CS3600 ***Introduction to Computer Security (4-0)*** This course is concerned with fundamental principles of computer and communications security and information assurance. It covers privacy concerns, notions of threats, vulnerabilities and risks in systems, malicious software, data secrecy and integrity issues, network security management, as well as DoD security policy and certification and accreditation of systems against security standards. Security mechanisms introduced will include access mediation, cryptography, authentication protocols, intrusion detection systems, multilevel secure systems, and public key infrastructures. Students will be introduced to a broad range of security concerns including both environmental as well as computational

security. Laboratory facilities will be used to introduce students to a variety of security-related technologies including, discretionary access controls, mandatory access controls in both low and high assurance systems, identification and authentication protocols and database technology in trusted systems. PREREQUISITES: Either CS3010 or CS3030 or the consent of the instructor.

CS4202 ***Computer Graphics*** (no course description)

Electrical and Computer Engineering courses

EO2514 ***Introduction to Communications Systems Engineering for ITM (4-2)*** A first course in communications systems for the Information Technology Management curriculum. The course considers basic electricity and electronics, signals and systems, and amplitude modulation transmission and reception. PREREQUISITE: MO1901.

EO3502 ***Communications Systems Technology and Application (2-2)*** A broad-based course in telecommunications systems engineering for a multidisciplinary audience. The course considers analog and digital communications systems. Specific topics include amplitude and angle modulation transmission and reception; baseband and passband digital modulation; system noise; transmission lines, waveguides and antennas; fiber optics; satellite communications. PREREQUISITE: MO1901.

EO3514 ***Communications Systems I (4-2)*** The second course in communications systems engineering for the C4I, Space Systems Operations, Information Technology Management, and other operational curricula. Coverage begins with a review of Fourier methods and covers analog and digital communications systems. Specific topics include amplitude modulation, angle modulation, the sampling theorem; spectral representation of pulse and digital signals; pulse and digital modulations; baseband coding forms; frequency and time-division multiplexing. PREREQUISITE: EO2514.

EO4514 ***Communications Systems II (4-2)*** The final course in communications systems engineering for the Information Technology curriculum. The course concentrates on hardware and systems that use the modulation techniques learned in previous courses. Hardware and systems discussed include cellular telephones, transmission lines, electromagnetic propagation, antennas, radar, microwave, and fiber optics. PREREQUISITE: EO3514.

Information Systems Courses

IS0810 ***Thesis Research (0-8)*** Every student conducting thesis research will enroll in this course.

IS2000 ***Introduction to Information Technology Management (3-1)*** Provide an introduction to the field of Information Technology Management and the functions and responsibilities of the information technology manager.

IS2020 ***Introduction to Object Oriented, Event-Driven Programming using Microsoft Visual Basic (4-1)*** A first course in computer programming using VB, DoN's IT21 mandated standard, as a high level, event-driven object-oriented, programming language. Course emphasis will be on planning, program development, graphical user interfaces, rapid prototyping, program construction, data types, operations, control flow, arrays,

records, file I/O, data base access, random number generators, and event-driven OOP structures. PREREQUISITES: None.

IS3000 ***Distributed Computer Systems (4-1)*** The technology, application and management of distributed computer systems. Specific topics include distributed processing, distributed data base management, communication facilities and protocols, economic and performance analysis, and managerial and organizational problems. PREREQUISITES: CS2970, CS3030, and IS3171.

IS3020 ***Software Design (3-2)*** The use of structured techniques in the design and implementation of software. Topics covered include selection of programming languages, design of modules and module interfaces, testing, and program documentation techniques. Use of software metrics for determining program size, complexity and quality. PREREQUISITES: CS2970, IS2000.

IS3100 ***Analysis of Microcomputers and Microprocessors (3-2)*** A comparative analysis of popular microcomputers-hardware and software. Analyses will be made of the following elements: microcomputer architecture; microprocessors; bus systems; operating systems and applications. Comparisons will be made both within a vendor's product line and between vendors, with respect to characteristics, strengths, limitations applications and costs. Student written and oral reports on comparative analysis. Some assembly language will be required. PREREQUISITES: CS2970, CS3030, and IS2000.

IS3112 ***Information Technology Management in DoD (4-1)*** Consideration of DoD information technology systems and their management development of a framework for understanding and managing systems based on the Technical Architecture Framework in Information Management (TAFIM). Command and control. Command and control warfare. PREREQUISITES: SECRET clearance and fifth quarter standing in the ITM curriculum.

IS3172 ***C4ISR Systems Evaluation (2-0)*** (no course description)

IS3181 ***Integrating and Leveraging Information technologies (3-0)*** The attributes of information technology are studied in conjunction with the management aspects of developing and maintaining systems in support for DoN and the Joint Services. This course is heavily project and case study oriented. Mini-cases force the student to apply theory from reading to realistic DoN settings. These case studies will force tradeoff, resource allocation decisions, development of strategy for specific problems, etc. PREREQUISITE: MN0123.

IS3185 ***Management of Information Technology (3-0)*** This course focuses on management issues in the implementation and use of information systems to support the missions of military organizations. It provides management students with a framework to comprehend the organizational impacts of information technology (IT) that will serve them throughout their careers despite rapid and continuous changes in hardware and software. They will know (1) what an IT system can do for their organization, (2) potential problems raised by IT and (3) how to work effectively with chief information officers and IT technical professionals. Topics include IT opportunities and strategies, IT implementation issues, IT staffing and the transformational effects of IT upon an organization's strategy, culture and operations. PREREQUISITES: MN3105, IS0123 and IS2010.

IS3201 ***Fundamentals of Database Technology (3-2)*** (no course description)

IS3301 ***Fundamentals of Decision Support Systems (3-2)*** Principles for designing, implementing and using computer systems that support a variety of decision making situations. Surveys or analytical techniques for decision making in complex environments, involving single or multiple criteria made under certainty and uncertainty, and techniques for automated inference are examined. The latest computer-based systems, and exemplary applications in DoD, that support or involve the use of formal decision making methods and tools are covered. Group project requires the design and implementation of a decision support system for a specific problem. PREREQUISITES: OS3004, OS3005, IS3201 (concurrent) and CC3000.

IS3502 ***Computer Networks: Wide Area/Local Area (3-2)*** Architecture, standard protocols, and technological advances in computer networks, with an emphasis on internet working and interoperability. Specific topics include open network architectures (OSI vs. DoD architecture), X.25, local area networks, TCP/IP, and a variety of distributed application services built on the client-server model. Students also gain an understanding of DDN (Defense Data Network), X.400-based DMS (Defense Message System), SDNS (Secure Data Network Service), and GOSIP (Government Open System Interconnection Profile). PREREQUISITES: CS2970, CS3030, IS2000, and OS3004.

IS3503 ***Microcomputer Networks (3-2)*** Theory, application, and operation of microcomputer networks. Students learn, evaluate, compare, and operate several contemporary microcomputer networks, such as IBM PC Net, IBM Token-Ring, Apple Computer Apple-Talk, 3Com Ethernet, mainframe emulations, and LAN internets. Students perform a variety of hands-on lab experiments on the SM department LANs to prepare them for future LAN management billets. The IEEE Local Area Network Standards will be addressed. PREREQUISITE: IS3502.

IS3504 ***Modern Network Operating Systems: Planning, Technology, and Operations (3-2)*** This course focuses on the planning, design, installation, configuration and management of network operating systems used throughout DoD and private industry. Network operating systems are compared with single user operating systems to understand differences and similarities. Popular client/server and peer-to-peer systems are examined to provide a thorough understanding of the correct applications of each. Network labs provide in-depth analysis of such topics as file server configuration and administration, multi-level network security procedures and global file server synchronization processes. PREREQUISITE: Computer Networks: Wide Area/Local Area (IS3502). Security Classification: None.

IS4031 ***Principles of Information Systems Evaluation (4-0)*** (no course description)

IS4182 ***Information Systems Management (4-0)*** Capstone course for the ITM curriculum. Based on information technology playing a vital role throughout the Department of Defense. Broad range of management, economic, behavioral, and technical matters associated with the development and operation of effective information systems. Its primary focus is on the strategic and policy issues facing DoD management. Topics covered include IS functions and operations, systems development methodologies, the IS infrastructure and architecture, IS planning, process reengineering, and technology assessment. PREREQUISITE: Status as student in the final quarter of the ITM curriculum.

IS4184 ***Information Resource Management in DoN/DoD (4-0)*** This course is concerned with understanding the major aspects of information resource management

(IRM) and how it is conducted in DoD and DoN. Special attention will be paid to database administration and information engineering. Examples of IRM and DBA practice will be presented via case studies and by speakers with relevant expertise from the Navy, DoD, and private sector. PREREQUISITES: IS3112, IS4183, IS4200, and IS4300.

IS4186 ***Knowledge-Based Systems and Artificial Intelligence (4-1)*** Principles, applications and limitations of knowledge-based systems, including expert systems, as problem-solving tools. Fundamental techniques, commonly employed in designing such systems, from the field of artificial intelligence. Specific topics include knowledge representation, automated reasoning, inference and search techniques, knowledge acquisition, and expert systems architectures. Hands-on experimentation and implementation of prototype systems. Students are expected to have a strong foundation in mathematical and analytical techniques. PREREQUISITES: IS2000, IS3171, IS4185, OS3105.

IS4187 ***Information Networking & Distributed Decision Technologies (3-2)*** Information technologies used for developing specialized applications on enterprise-wide or global information networks such as the World Wide Web. Focal topics include methods and applications of information networking; distributed libraries of computational and decision technologies; and management of large-scale applications. Applications involving remote execution of interactive decision technologies and the organization of a large collection of such applications into a distributed digital library. Examines applications and their implementation using emerging technologies and development of applications that are scalable and maintainable. Other topics include architectures and protocols for information networks, client-server computing, electronic commerce, pricing of information products and security. PREREQUISITE: IS3171, IS3502, IS4185, and IS4502 taken concurrently.

IS4220 ***Architecting Information Systems (3-2)*** (no course description)

IS4300 ***Software Engineering and Management (3-2)*** The objective of this course is to educate the student in areas of great concern to the Department of Defense in the fields of software engineering and management. The course examines both the technological tools of software production as well as the software engineering techniques for software project management. Software testing, metrics and reliability are also covered. DoD software standards and metrics programs are included. PREREQUISITES:
CS3030, IS3020, IS3171, IS4200, OS3004.

IS4503 ***Internet to Sea (2-2)*** Internet capabilities will radically change maritime military operations study of the technological issues involved in bringing Internet capabilities to the maritime environment. Technological issues include network protocols, security, and commercial infrastructure. Use of commercial capabilities for military communications. Policy and planning issues. PREREQUISITE: IS4502. Security Classification: Unclassified.

IS4800 ***Directed Study in Advanced Information Systems (Variable Hours) (V-V)*** Directed study in advanced topics in information systems of mutual interest to student and a faculty member. Intended primarily to permit students to pursue in-depth subjects not fully covered in formal class work or thesis research. May be repeated for credit with a different topic. Graded on a Pass/Fail basis only.

Information Warfare Courses

IW3101 ***Principles of Information Operations (4-1)*** This course provides a survey of Information Operations (IO) along the time line of peace, to conflict, and back to cessation of hostilities. Students study the methods and elements which contribute to successful Information Operations including: Psychological operations and deception, Operational security, information assurance, and infrastructure protection, Electronic attack/protect/support, Physical attack/destruction in support of IO, Military-civilian relation-ship, Human cognition and decision making, Command and control structures, Legal issues, Computer and network attack, Systems engineering concepts (including modeling and simulation), Sensor and signals intelligence support to IO. PREREQUISITE: None. Security classification: SECRET.

Mathematics Courses

MA1010 ***Algebra and Trigonometry (5-0)*** Real number system, complex numbers, exponents and radicals, algebraic expressions and operations, linear and quadratic equations, inequalities, functions and graphs, polynomials and their zeros, rational functions, exponential and logarithmic functions, systems of equations, matrices, trigonometry and unit circles, trigonometric identities and functions. PREREQUISITE: None.

MO1901 ***Mathematics for ISSO (3-0)*** A brief survey of selected calculus and post-calculus topics - single variable derivatives and integrals, infinite series and sequences, complex numbers, and Fourier series and transforms. (This course may not be taken for credit by students in an engineering or science degree program nor may it be used as a prerequisite for any other mathematics course.) PREREQUISITE: None.

Systems Management Courses

MN2155 ***Accounting for Management (4-0)*** Study of the fundamentals of financial and managerial accounting relevant to financial management. Introduction to financial accounting stressing accrual concepts and the content and analysis of financial statements. More in depth focus on management accounting topics, including costing techniques for products and programs, use of cost information for decision making, capital budgeting, and financial performance measures. Applications of managerial accounting tools to DoD situations. (May not be substituted for MN2150 and MN3161.)

MN3154 ***Financial Management in the Armed Forces (4-0)*** This course focuses on financial management practices and concepts in the DoD, with emphasis on the Department of the Navy. Topics include appropriations and legal aspects of appropriations; the Future Years Defense Program; the Planning, Programming and Budgeting System (PPBS); budget formulation, review, enactment and execution cycle; federal budget legislation and DoD regulations; ethics in government; management controls; and, DoD accounting terminology and accounting systems. Current financial management issues such as working capital funds, DFAS, non-appropriated funds and unit cost are reviewed. Exercises and case studies are used to

develop the students' ability to apply financial management concepts to real life situations. PREREQUISITE: MN2155 or MN3161.

MN3331 ***Principles of Systems Acquisition and Program Management (5-1)*** This course provides the student with an understanding of the underlying concepts, fundamentals and philosophies of the systems acquisition process and the practical application of program management methods within this process. The course examines management characteristics and competencies, control policies and techniques, systems analysis methods, and functional area concerns. Techniques for interpersonal relationships will be examined in team exercise settings. Topics include the evolution and current state of systems acquisition management; the system acquisition life cycle; user-producer acquisition management disciplines and activities; and program planning, organizing, staffing, directing and controlling. Case studies are used to analyze various acquisition issues. PREREQUISITE: None.

MN3374 ***Production and Operations Management (4-0)*** Qualitative issues and quantitative techniques for managing DoD production and service operations. Qualitative issues covered include process design, operations strategy, and Just-In-Time techniques. Qualitative techniques include quality monitoring and measurement, forecasting, queuing, scheduling and aggregate planning. The context is DoD production and service activities, with special emphasis on DoD repair depot processes. PREREQUISITE: OS3006.

MN4105 ***Strategic Management (4-0)*** Study and analysis of complex managerial situations requiring comprehensive integrated decision making. Topics include operational and strategic planning, policy formulation, executive control, environmental adaptation and management of change. Case studies in both the public and private sectors are used. Particular attention is given to strategic management in the military context, and in the DoD, DoN organizations. PREREQUISITE: Open only to students in the final quarter of a Systems Management curriculum, or Information Technology Management, or permission of instructor.

MN4125 ***Managing Planned Change in Complex Organizations (4-0)*** Examination of the approaches to planning and managing change efforts in complex social systems made up of the interdependent components of technology, structure, task, and people and of the role of the manager or staff specialist and the process of helping. Emphasis is placed on strategies and technologies for diagnosis and planning aimed at effective implementation. Opportunities for practice using both simulations and actual organizational cases. Particular emphasis is placed on the DoD, DoN organizations and the special problems they have in bringing about change. PREREQUISITE: MN3105.

MN4151 ***Internal Control and Auditing (2-0)*** Study of the objectives and activities of internal control. Overview of audits of financial reports and records and of government operations, in accordance with Government Auditing Standards. Specific topics include the design and evaluation of internal controls, auditing standards, audit reports, audit evidence, and audit tests. PREREQUISITE: MN3161.

Operations Research Courses

OS3004 ***Operations Research for Computer Systems Managers (4-1)*** A one-quarter survey of operations research techniques of particular interest to students in computer systems management. Topics covered include optimization, network flow models, simulation, queuing, forecasting techniques, Markov chains, decision analysis, reliability, and project management techniques. Spreadsheet models and analysis tools are an integral part of the course. PREREQUISITES: MA2300, OS3101.

OS3105 ***Statistics for Technical Management (4-1)*** The first of a two-quarter course in the use of the tools of probability and statistics oriented toward management applications. Skills in numerical computation are developed in laboratory periods through the use of MINITAB. Emphasis in the lectures is placed on modeling problems and interpreting results. Those aspects of probability structure which are germane to distributions such as the binomial and normal. Standard topics of statistical inference for one and two variables are introduced in the settings of both hypothesis testing and confidence interval estimation. PREREQUISITE: Calculus.

OS3404 ***Man-Machine Interaction (3-2)*** An introduction to the man-machine interface problems in C3. Information, display and human communication requirements for effective C3. Applied orientation involving message handling systems, query languages, computer to computer communications, command and control applications programs, file transfer between host computers, etc. PREREQUISITE: Enrollment in the Joint C4I curriculum.

Joint Professional Military Education Courses

NW3230 ***Strategy and Policy: The American Experience (4-2)*** This course is a tailored version of the Strategy and Policy (S&P) course taught at the NWC in Newport, RI. It has been revised to focus on the critique of strategies and their utility in achieving a nation's policy objectives. The course utilizes case studies derived from the American experience. This course is mandatory for all DON students, and it will be taught by NWC faculty during the normal academic day. (This course replaces the previously mandatory course NS3252 Joint and Maritime Strategy). Completion of this course will earn four graduate credit hours, and represents one-third of the entire NWC program. PREREQUISITE: None.

Physics Courses

PH3052 ***Sensor Technology and Application (3-0)*** (no course description)

Space Systems Courses

SS3011 ***Space Technology and Applications (3-0)*** An introduction to space mission analysis with an emphasis on those space missions supporting military operations. Topics include space history, doctrine and organizations, orbital mechanics, communication line analysis, space environment, spacecraft technology, and military, civil and commercial space systems. PREREQUISITE: MO1901.

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Alexandria, VA

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